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THE ALPS OF QUNGUR

C. P. Skrine, I.C.S.

Read at the Meeting of the Society, 27 April 1925. Map follows page 480.

IN January 1922 I was fortunate enough to be appointed to the officiating charge of the British Consulate-General at Kashgar, and proceeded at once to make arrangements for the journey of my wife and myself to that ancient city by the Srinagar–Gilgit route. One of my first proceedings was to go to Delhi and consult Sir Aurel Stein as to whether there was anything I could do, in however small a way, to supplement his great explorations in Chinese Turkistan. Hearing I was going by the Gilgit–Tashqurghan route he at once suggested my trying to go down the Qaratash valley and examine the eastern face of the Qungur massif, which no one had as yet seen, and particularly its south-eastern offshoot, the Shiwakte Mountains. He himself, he told me, had in September 1913 been the first traveller to cross the Buramsal pass and follow the Qaratash river to its debouchure 36 miles due south of Kashgar; but owing to shortage of time, lack of supplies, and the extreme difficulty of the Qaratash gorges he had been unable to ascend any of the side valleys coming down from the Shiwakte and Qungur, and had had to confine himself to a plane-table traverse of the main Qaratash gorge. The latter is so deep and perpendicular-sided that he caught no glimpse from it of the main range to the west. This was quite enough to decide me to explore those side valleys of the Qaratash at all costs, and accordingly in April, before proceeding to Srinagar, I went to the headquarters of the Survey of India at Dehra Dun and invoked the aid of the Superintendent, Col. Cowie, and his assistant, Major Perry.

I may mention here that my sole qualification for survey work in unexplored mountain regions was having undergone nine years previously a short course of land records training in the United Provinces, during which another budding civilian and I had co-operated in a plane-table survey of a nine-hole golf-course near Cawnpore. None the less, the Survey officers were as kind and encouraging as could be, not only

lending me a complete plane-tabling outfit, but spending valuable time in coaching me for two days in the rudiments of field survey work. Col. Cowie agreed with Sir A. Stein that the blank patches in Survey of India Sheet 42 N (serial No. 2 of Stein's half-million-scale maps of Chinese Turkistan and Kansu), that is to say between the 75th and the 76th meridians and the 38th and 39th parallels of latitude, would be well worth my while trying to visit on the way to Kashgar.

The Drawing Office happened at the time of my visit to be engaged on the very sheet in question, an advance copy of which was specially heliozincographed on to cardboard for use on a plane-table. This map shows clearly the two great massifs of Qungur and Muz Tagh Ata, which are the twin culminating points of the meridional range, usually known as the Kashgar Range, which connects the westernmost Kunlun with the Tien Shan in the north and forms the eastern rim of the Pamir region.

For many years great uncertainty existed as to the height of the two massifs and even as to the identity of the northern one, which is visible (though only rarely) from Kashgar. This massif was fixed by Trotter in 1873–4 under the name "Tagharma." Sven Hedin and the Russian cartographers regarded Muz Tagh Ata as higher than its northern rival, Qungur, but do not appear to have given any height for the latter. Capt. Trotter's value for it was 25,350 feet. According to the Survey of India Triangulation Pamphlet on Sheet No. 42 N :

"Deasy, in 1899, measured a base of 6 miles at Kashgar, observed Kungur, and obtained a height of 23,350 feet for it, or 870 feet lower than Muztagh-ata (*Geographical Journal*, XVI., 1900, p. 521). In 1900–01 Stein obtained two values for Kungur, viz. 23,600 feet and 25,146 feet * ; the former value was at first adopted and is shown on his map of the expedition. Subsequently the agreement of his higher value, 25,146, with Trotter's value, led to the adoption by the Survey of India of this value, and Stein's map after his 1906–08 expedition shows two summits, 25,046 feet and 25,146 feet, in this neighbourhood. Great uncertainty therefore still exists as to the heights of the summits of this massif, and Kungur II. (25,046) previously accepted by the S. of I., has now been deleted."

The telepanoramas exhibited in the lecture show the two summits clearly, Qungur II. on the left and Qungur I. on the right. I am glad to say that one of the results of my amateur efforts has been to enable the Survey of India to fix with some exactitude the position of Qungur II. and to calculate its height provisionally as 25,200 feet, or slightly higher than Qungur I.†

* *I.e.* for Qungur II. and Qungur I. respectively.

† See Major K. Mason's 'Notes on the Compilation of Mr. C. P. Skrine's Topographical Material in the Neighbourhood of the Qungur Massif,' Appendix I., para. 7 *ad fin.*

In order to gain access to the eastern flanks of the Qungur massif and of the mysterious range to the south-east of it named by Stein (from the Pamirs side) the Shiwakte, it was necessary for us to penetrate the gorges of the Qaratash river mentioned above as having been traversed by Stein alone among previous travellers. The upper waters indeed of this river are comparatively accessible, for there is a route, used occasionally by Afghan opium smugglers, which goes from Qara Köl over the Qaratash Pass (16,338 feet) into the valley of that name and out of it again by the Ghijaq Pass to Ighiz Yar and the plains. But this route only traverses a stretch of about 6 miles of the main valley, and that not an interesting one; the difficult part is lower down, from Chimghan Ayaki to Khan Terek. The first attempt to force these gorges was in 1906, when Stein detailed Ram Singh to try and reach Kashgar by this route.* Ram Singh crossed the Buramsal Pass † and descended the Qaratash as far as the main gorges, but was unable owing to the volume of water to go further and to cross the Ghijak Pass and rejoin the ordinary Kashgar road at Ighiz Yar.

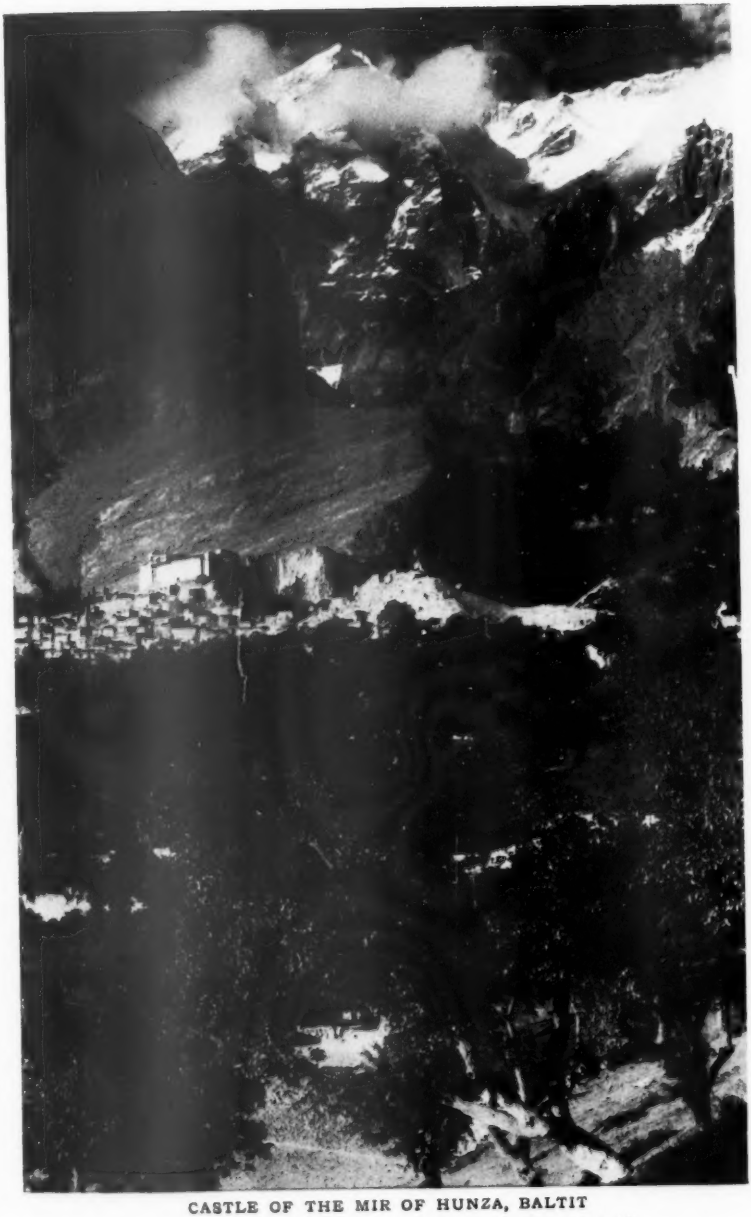
It was not till Stein's third expedition, in September 1913, that the Qaratash valley was traversed throughout by Stein himself. He describes his journey as follows:

"I myself set out for the same goal (Kāshgar) with Muhammad Yakub by a new route leading due northwards across the Merki pass and down the valley of the Qaratash or Beshkan river. Owing to special difficulties this important valley, in which most of the eastern drainage of the great glacier-clad range of Muz-tagh-ata finds its way into the plains between Yangi-hissar and Kāshgar, had never been explored in its whole length. During spring and summer the big floods from the melting snow and ice of the range render the extremely narrow gorges of the Karatash river in the north quite impassable. By the time the waters subside in the autumn, heavy snow on the Merki and Kara-tash passes closes the approach from the south. In the spring of 1906 I had sent Ram Singh to descend the valley, but the flooded river had obliged him to abandon the attempt. We were more fortunate this time. Exceptionally early snowfalls had stopped the melting of the glaciers just in time to allow of a passage while the Buramsal pass (14,940 feet), though under deep snow, could still be traversed with laden yaks. Nevertheless the descent through the extremely confined gorges of the river below Chimghan proved very difficult and in places risky. The constant crossings of the river tossing between precipitous rock walls could not have been effected without the help of hardy local camels secured from Kirghiz camps higher up the valley" ('Memoir on Maps of Chinese Turkistan and Kansu,' p. 25).

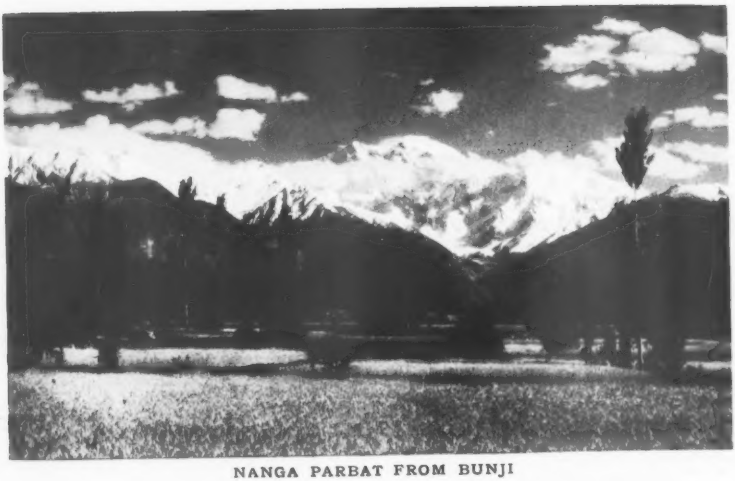
* 'Memoir on Maps of Chinese Turkistan and Kansu,' p. 11.

† The pass crossed by Ram Singh on this occasion was probably the Buramsal, not the Merki pass, as stated in the Memoir.

Leaving Srinagar on 3 June 1922, my wife and I and a friend, Mr. G. C. Price, travelled up *viâ* Gilgit and the Mintaka Pass to Tashqurghan, which we reached on July 6, and halted there a couple of days. Thence taking the ordinary summer route to Kashgar, we crossed the southernmost slopes of the Muz Tagh Ata massif and camped on the Chichiklik or "flowery" plateau at a height of about 15,000 feet. To the east of this, the route followed by Stein on both his journeys, and by most travellers on this road, goes straight down to Toile Bulung in the Pasrobat valley by the Tangitar gorge, in which the going is notoriously bad during the high-water season. In order to avoid it and also to strike less-known ground I decided to cross the Yangi Davan to the north of Chichiklik and go down the Yambulaq Jilgha. The pass (16,100 feet) proved easy, though the snow lay deep on the north side and it was necessary to lead the ponies down carefully. We were interested to find, lapped among the snowy peaks at the head of the Yambulaq Jilgha, 15,000 feet above the sea, a beautiful lake about $1\frac{1}{2}$ miles long by $\frac{1}{2}$ mile broad, still partly covered by the ice of winter. This lake is not marked in the Survey of India map, nor is it mentioned by any of the authorities I have read. We halted for a couple of nights at the hospitable camp of the Yambulaq Qirghiz about halfway down the valley, my object being to reconnoitre the Merki pass and see if it would be possible to take our caravan over into the upper Qaratash valley. I knew it would not be possible to go down through the gorges, but I thought of halting two or three days in the upper part of the valley, exploring the Chimghan Jilgha which promised easy access to the Shiwakte, and then rejoining the ordinary Kashgar road by the Ghijaq Pass route. Accordingly on July 12 Price and I started for the Merki Pass with five yaks and three sturdy Qirghiz. To cut a long story short, we found the "pass" not to be a real pass at all, nothing but a lofty ridge of rock at least 17,000 feet high, deep in snow even on the south side and defended also by an apparently perpendicular wall of ice. After five hours of scrambling up among enormous boulders and through soft snow in which the yaks often floundered helplessly, we left the animals and climbed on foot to the summit of a spur, 16,500 feet high, which commanded a good view of the "pass" above us to the north, and of a vast expanse of tumbled mountains to the south and west. Muz Tagh Ata and Qungur were unfortunately buried in clouds—as I was to find out later, it is useless to try to get a view of the giants after about ten o'clock—but the little-known peaks of the upper Yarkand River valley stood up grandly to the south. We were interested to observe two more lakes, one a small tarn immediately below us to the north-west, the other a large sheet of water on the opposite (south) side of the Yambulaq Jilgha, lying at an elevation of about 1000 feet above the valley-bottom. We thus found altogether three lakes in the catchment area of the Yambulaq Jilgha; there are two small tarns also on the Chichiklik plateau. The upper Yambulaq



CASTLE OF THE MIR OF HUNZA, BALTIT



NANGA PARBAT FROM BUNJI

IN THE HUNZA GORGES

valley, in fact, together with the Chichiklik Maidan and the rolling hills in the neighbourhood, constitutes a piece of typical Pamir country, lakes and all, on the east side of the meridional range; the only such region to be found surviving, as it were, among the peripheral gorges south of the Gez Dara.

From our reconnaissance it was clear that the Merki "pass" was quite impracticable for loaded animals; the Qirghiz indeed told us that it was hardly ever used, even by them. The only thing to do, therefore, if we wanted to reach the upper Qaratash Valley, was to go down to Toile Bulung and over the Buramsal Pass. This would have entailed three extra marches and trying ones at that, so, as time was short and the Qirghiz also frightened us with accounts of the volume of water in the upper Qaratash valley, I decided to abandon for the time being my attempt to reach Chimghan and the Shiwakte. Crossing the Tari Art (13,340 feet) and Kashka Su (12,900 feet) passes without difficulty, we at last, on July 18, emerged from the mountains at Ighiz Yar and reached Kashgar three days later. I shall never forget the view of the snows of the Kashgar range which we saw as we crossed the fertile plains of the Yangi Hissar and Kashgar districts; all the great massifs with their lesser satellites were clearly visible for a hundred miles or more to the south and west. I did not know then how rare this beautiful spectacle is, and it was not till May 1923, ten months later, that I succeeded in obtaining a good telepanorama.

On 11 October 1922 we left Kashgar on a two-and-a-half-months' tour on Consular duty to Yarkand, Khotan, and Keriya. Instead of going straight to Yarkand, however, we turned off the main road at Yapchan and marched *viâ* Akhtur Bazar, a picturesque village with a large ruined fortress on the banks of the Qaratash river (here wide and shallow as it flowed over the plain) to Altunluk, at the debouchure of the same river from the foothills of the Kashgar range. We were accompanied by a member of the small colony of "White" Russians at Kashgar, Mr. Paul Nazaroff, a mining geologist well known at Tashkend before the Revolution. Our baggage and unmounted retinue went on seven shaggy two-humped "Bactrian" camels, for the hire of each of which we paid the princely sum of *2s. 4d.* a day. The Chinese magistrate of Yangi Hissar, with whom we had made great friends on our way to Kashgar in July, gave us all the assistance in his power and sent with us the Beg of the valleys for which we were bound, an excellent old man who, unlike some others of his kind we have met, always did his best for us and gave us no trouble whatever.

The people of Altunluk, where we camped in a pleasant orchard gay with autumn tints, did all they could to dissuade us from venturing up the Qaratash Valley, but had to admit that the season was well advanced and the summer floods lessening. Whenever one leaves the beaten track the local people, usually backed up and sometimes in-

stigated by their Beg, invariably take this line, so that if anything untoward happens they can say, "We told you so." This is the more necessary from their point of view in that the Chinese always come down heavily on the Beg concerned if anything happens to a foreigner when travelling in the districts, and the Beg of course takes it out of the local people.

Accordingly, on October 14 we started up the right bank of the Qaratash, which here flows in a wide valley between low barren hills. Fording the river without difficulty 8 miles above Altunluk, we continued for 9 miles along the left bank among gradually rising but bare and much-eroded foothills. The river had then to be crossed and recrossed at a point where it breaks through a transverse ridge of red sandstone about 9000 feet high, forming narrows through which the water rushes with some force. The maximum depth at the fords above and below the narrows was 4 feet and the current about 5 miles per hour, while the stream was roughly 30 yards broad. A wide and almost straight reach of the Qaratash some 5 miles long was now entered, and a mile farther up we came to the first signs of occupation by the Qirghiz of the mountains at Saman. Here there were two tumbledown crofts and a few acres of land which had once been under the plough, now deserted, and here also we found a pleasant little grove of planes and desert poplars (*P. varifolia*). We camped here for the night and proceeded up the left bank next day. This morning for the first time the dust haze, which throughout the Tarim basin is the bane alike of the surveyor and of the landscape photographer, began to disappear, and we saw dimly, rising grandly above the river valley straight in front of us, a magnificent snow-peak which we afterwards found to be the outermost aiguille of the Shiwakte, Kök Dŏng, 16,800 feet high. A mile or two above Saman this peak was hidden by the nearer hills which rise steeply 3000–4000 feet above the valley bottom, here some 6000 feet above the sea. They consist of much-decayed grey limestone with, at one point, a well-defined belt of red sandstone, and are a continuation of the Zor Qir ridge which encloses the Yapchan valley on the north. The Qaratash makes a right-angled bend as it cuts through this ridge at the narrows of Achiq Aghzi. Another wide reach some 4 miles long, in which the river runs south-east to north-west, is here entered; there must have been a lake here before the river cut through the above-mentioned ridge, for three different "raised beaches," one above the other, are plainly visible on the hillsides above the right bank.

At the upper end of the narrows there is a Qirghiz bridge of primitive cantilever type leading to a plot of 40 or 50 acres on the right bank with two tiny farmsteads, all the irrigation of which is done from a wooden aqueduct carried high over the bridge. On the left bank is a pleasant little apricot orchard with a mud-brick farmstead attached, called Qurghan (fortress), from a small tower the remains of which can still be seen. The valley just above here is at its widest, and a comparatively large plot

of ground is cultivated with barley and lucerne ; the place is the winter headquarters of the Qirghiz of the Chopqana Jilgha, one or two of whose huts * are usually to be found here even in summer. At this our first visit the place was deserted ; as we afterwards found out, the Qirghiz, alarmed at the approach of a large cavalcade, had fled with their flocks and herds up to their highest fastnesses. On our return journey, however, and on each subsequent occasion that we passed this spot, the Chopqana Qirghiz always had a hut and some food ready for us, and some of them, men and women, were usually there to receive us.

A mile above Qurghan, we crossed once more to the right bank ; it was the last easy ford we were to have, for 5 miles further up the valley suddenly narrowed and we found ourselves entering the gloomy portals of the dreaded gorges which only Stein had penetrated before us and about which he had spoken so feelingly.

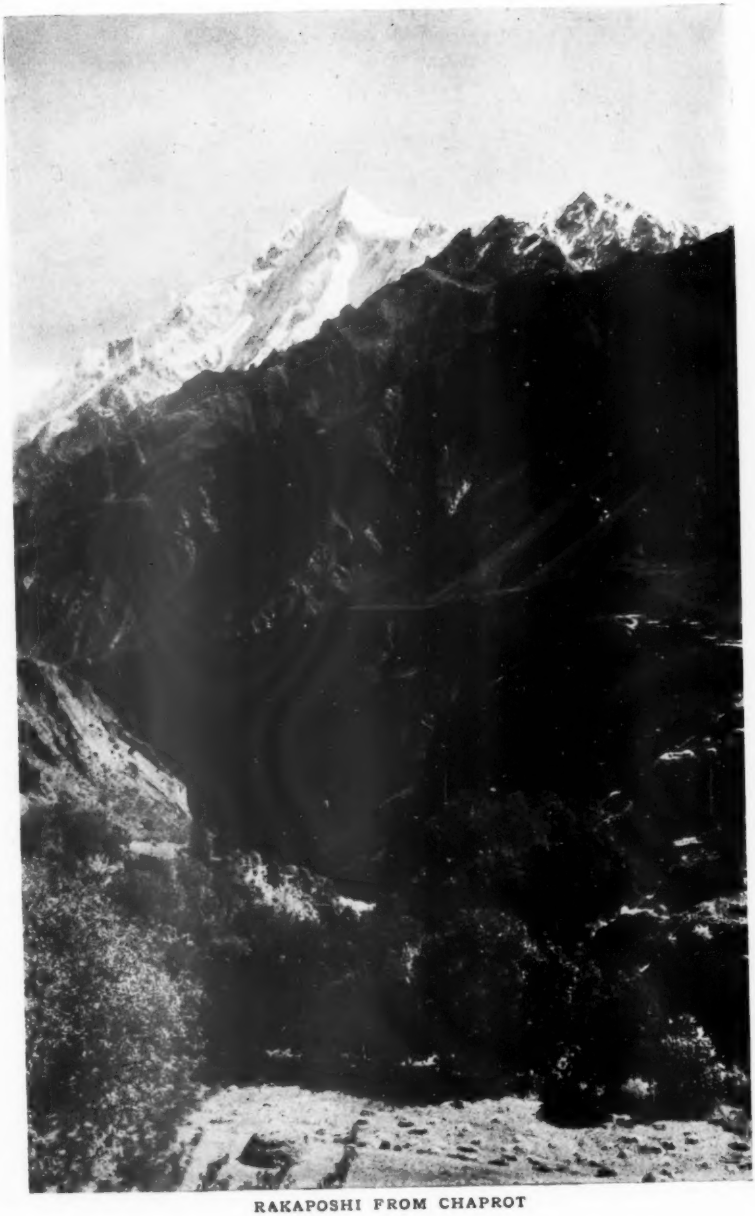
We had to cross the stream nine times in the next 3 miles, and although there were no rapids and the river-bed was in every case comparatively smooth, the fords were none of them easy to cross on horseback. Our baggage-camels had no difficulty, their extra length of leg giving them an advantage over the horses. Stein, it will be remembered, used local camels when he came down through the gorges three weeks earlier in the year (' Memoir,' p. 25). Even so most of our baggage got wet.

At Bash Kupruk (" Bridge-head "), where there used to be a bridge giving access in summer from upstream to the valleys on the right bank, the gorge widens somewhat, and we pitched our tents in a grove of tamarisk and willow which gave us welcome shelter from the icy wind. Firewood was plentiful, we had a week's supplies with us, and there was good grazing for the camels, so we decided to halt for a day or two and give the animals a rest. The gorge, we were told, was much narrower and the stream quite unfordable further on, and it seemed advisable to reconnoitre before attempting a further advance. A mile ahead I noticed a spur coming down from the west, the direction of Qungur, which seemed distinctly less unscalable than the rest. Sending one of our orderlies with a Qirghiz guide up the main gorge to report on the state of the water and the possibility of getting through to Chimghan, I myself set up the plane-table first at the mouth of the Kaying Jilgha, and then 2000 feet up the ridge to the south-west, at a point which I fixed from below and marked with a cairn (Stn. I.). From this point I obtained a tantalizing though still rather hazy view of snow-clad peaks not more than 7 or 8 miles away to the west, apparently enclosing the head of the Kaying Jilgha. Below me the Kaying stream rushed

* The Qirghiz nomad hut, known in Kashgaria as *aq-oi* or " white house " from the grey felts used, consists of a collapsible circular lattice framework of wood covered with large felt mats, with an aperture in the top which acts as chimney and window by day and can be covered with a mat by night to keep the warmth in. The word *yurt* used for these huts in Russian Central Asia means " village " in Kashgaria. The Tajiks of the Pamirs have copied the Qirghiz nomad hut, which they call Khirga.

through a rocky but by no means impassable gorge ; while right opposite me to the north-west rose a high double-peaked mass of dark grey limestone which I identified as " Kaying-beli," the last peak shown in this direction on Stein's map. Though exceedingly steep and even precipitous, I thought I could climb this peak, from which it appeared almost certain that I would obtain the longed-for view of the east face of Qungur and maybe of the mysterious Shiwakte (about which my guide could tell me nothing) ; so I fixed both the points of Kaying Beli carefully and decided to try and climb it next day from the same camp. I also drew rays to as many of the peaks of the Qaratumush and Pitlik Jilghas as I could ; the further course of the main Qaratash river was invisible, for the stream seemed to issue from under a great rocky wall about 10,000 feet high.

I was disappointed but not surprised when the orderly whom I had sent up the main gorge to reconnoitre reported late that evening that further up it became so narrow and the current so deep and strong that there was no hope of our getting through to the mouth of the Chimghan Jilgha with the whole of our caravan, if at all. I had no intention of risking the lives of members of our party or of our animals in the raging waters of the Qaratash, so once more I reluctantly decided to give up the attempt to approach the Shiwakte *viâ* the Chimghan Jilgha, and to explore instead the Kaying valley and see whether there was a pass at its head giving access to the eastern foot of Qungur. Accordingly, next day at 7 a.m. I started out with plane-table and camera to climb Kaying Beli, accompanied by a Qirghiz guide and the best cragsman among my orderlies, an excellent young Hunza man of splendid physique called Sangi Khan. Striking up the Kaying Jilgha a mile above camp we followed the stream for another 2 miles to the mouth of a steeply pitched ravine, 7800 feet above the sea, from which we climbed straight up in four hours to the top of the eastern summit of Kaying Beli, 12,750 feet high. The climb was arduous and in many places difficult, but so magnificent was the panorama that gradually unfolded itself as we ascended that I at any rate was much too excited to notice the fact. Unfortunately the higher peaks, which on the way up had been clear, had already begun to veil themselves in cloud and to a certain extent also in dust haze by midday, when I was ready with my plane-table perched on the topmost pinnacle of rock. Nevertheless I obtained a panorama good enough for surveying purposes, together with a complete set of plane-table rays and clinometer readings, of a large number of peaks right round from north-west to due east, including the following : Sargalang ; the Chakragil massif ; Qungur I. ; Qungur II. and the Shiwakte group approximately (they were mostly under cloud) ; the whole array of peaks enclosing the Tigarman Su, Kaying and Qaratumush Jilghas, and on the opposite side of the main Qaratash valley the beautiful snows of the Ghijaq and Pitlik ranges. It must be understood of course



RAKAPOSHI FROM CHAPROT

CROSSING YAMBULAK DAVAN

UNMAPPED LAKE AT HEAD OF YAMBULAK JILGHA

KAYING JILGHA AND SHIWAKTE PEAK I.

QIRGHIZ OF QARATASH VALLEY

that I had very little idea of the identity of all these points on this, the first time I ever succeeded in reaching a coign of vantage among the forest of peaks in this area.

As often happens, the descent of Kaying Beli was much worse than the ascent, especially as the guide lost his way in attempting, against my wishes, to take us down by a short cut. Sunset found us on the edge of a 60-foot drop into the ravine we had ascended in the morning, faced with the alternatives of climbing about halfway up the mountain again or going over the side. The former was out of the question, as it would have meant being benighted in intense cold among the waterless crags of Kaying Beli. Before attempting the descent we traversed an exceedingly unpleasant grass slope pitched at an angle of 40° in the hope of finding an easier descent round the corner, but without success. Finally we took our courage in both hands and went over the side, and thanks chiefly to the admirable steadiness of Sangi Khan we reached the bottom of the cliff without mishap. Even then our troubles were by no means over, for there were several "dry waterfalls" to descend before we reached the bottom, and it was quite dark when we found ourselves with much relief in the valley-bottom of the Kaying Jilgha.

My wife and Nazaroff, who in their natural anxiety had come out with a search party and met me a mile from camp, greeted me with the interesting news that they had spent the day in a reconnaissance up the Kaying Jilgha; that the gorge was practicable for our convoy; and that two hours' march up it the jilgha widened into a broad valley encircled by magnificent peaks, in which they had found two or three Qirghiz families with their huts pitched in a sunny corner. The latter were ready and anxious to provide us with huts to sleep in if we came up. Needless to say we decided to take them at their word, and next day, leaving the tents at Bash Küprük in order to lighten the loads, we moved up the Kaying Jilgha and camped in the Qirghiz huts. On the way up I measured a base-line 1350 yards long in the only straight stretch I found in the gorge, and from it fixed with greater accuracy the relative positions of Stn. I., Stn. II. on Kaying Beli, the mouth of the jilgha and several other minor points in the neighbourhood; this was all I had afterwards on which to build my map of the Kaying Jilgha and its mountain system, and to connect it with Stein's route traverse of the Qaratash gorges. In all this region the great difficulty is that the chief summits are hardly ever visible from the valley bottoms.

Our new camp was at an elevation of 9200 feet, and the thermometer at night went down to 10° or lower; the felts of our huts were full of holes (for our kind hosts were very poor), so that we had the full benefit of the night winds and were inclined to congratulate ourselves on not having exposed ourselves to the still greater elevations of the Chimghan Jilgha, the very mouth of which is over 10,000 feet above the sea. But the dust-haze had gone, the brilliantly clear weather of late autumn

in Central Asia had set in, and when we saw what the upper Kaying Valley had in store for us we soon forgot any minor discomforts we might have suffered. For next morning we all three, escorted by the Qirghiz, rode up the valley towards the magnificent peak afterwards designated as Shiwakte I.; before we had gone a mile we found ourselves in a wood of big juniper trees, and, topping a rise, saw before us, nestling at the foot of black precipices 6000 feet high, a fine virgin forest of tall firs,* their deep shade contrasting perfectly with the brilliant snows of the Shiwakte behind. We were astonished and delighted, not only by the beauty of the scene but by the interest of our discovery, for it had not hitherto been known that fir forests of any size existed south of Bostan Arche, 50 miles away to the north-west under the snows of Ulugh Art, where Stein found conifers in 1915 at the end of his Third Expedition ('Memoir,' p. 40). The firs began to grow thickly, with individual trees 100 feet high or more, at an elevation of 10,000 feet and continued up to 12,000 feet. Yaks were waiting for us in a clearing of the forest, and mounted on these we reached by one o'clock a height of 13,100 feet on the lateral moraine of the Torbashi glacier, a tributary of the main Kaying glacier. Here we were surrounded by an array of precipitous snow-peaks from 17,000 to 19,000 feet high, their faces clothed with hanging glaciers; far below us we could see the forest and the milk-white glacier-stream curving away behind tremendous black pinnacles towards the main gorge.

Next day, the last we could spare in the valley (for we were due on October 26 in far Yarkand and were already likely to be late), I climbed with Sangi Khan and two Qirghiz carrying my plane-table and cameras to a height of 13,430 feet on a splintered rock-ridge called Nichke Qir, immediately under the high chisel-shaped peak of Kök Döng, that same offshoot of the Shiwakte, 16,800 feet high, which we had seen from Saman. The climb, though exceedingly steep, was not so difficult as that of Kaying Beli, and the air was this time perfectly clear; I was thus able to spend three hours at this station (No. III.) and take a panorama of, as well as rays to, most of the same peaks I had photographed from Stn. II. Qungur II. (which I then mistook for Stein's Qungur I.) was just visible over the top of the Kök Döng ridge, and with one of the very few slow plates I had with me I obtained an excellent telephotograph, the first ever taken of the east face of Qungur.

I was greatly helped in the identification of the peaks I had seen from Stn. II. by having with me the negatives of the panorama I had taken at the latter station, and had, as usual, developed in camp as soon as possible. In a region where you seldom see the higher mountains between stations, the great difficulty is identifying peaks seen from different points; Stein had warned me of this, and it was for this reason

* Similar in appearance to, and probably identical with, *Picea Schrenkiana* of the Tien Shan.

that I always carried a developing outfit with me in camp. I could thus compare the view I was looking at with the negatives of photographs I had taken of the same mountains from other stations, and identification of salient points was comparatively easy.

I was thus able to plot in many of the peaks and glaciers I had seen from Kaying Beli. But I still could not see more than a small fraction of the east face of Qungur, and the configuration of the Shiwakte range was not at all clear to me, owing to the great ridge of Kök Dŏng and Sarigh Yon which partially concealed the view to the west and south-west. I saw that I must somehow or other, during my next visit, conquer the knife-edge ridges which completely enclose the upper part of the Kaying Jilgha.

On our return journey down the Qaratash we reached Qurghan by a short cut from the upper Kaying valley by crossing on yaks the steep but easy Chopqana pass (11,500 feet) immediately above our camp and descending the jilgha of the same name. This valley is about 8 miles long, and its stream, not being fed by any glacier, is small, but it boasts several patches of fir forest clinging to the north face of the Kaying Beli ridge, and, the grazing being good, several families of Kirghiz inhabit it. The stream joins the Qaratash a mile above Qurghan. There was quite a muster of Qirghiz at the latter place, and next morning when we struck camp they seemed genuinely sorry to bid us adieu and begged us warmly to come again next year.

Leaving Qurghan we sent the caravan to Saman only, as we intended to reconnoitre the Achiq Jilgha, at the top of which I had heard there was a pass leading over to the Gez River. The map shows the Achiq Jilgha as trending from west-south-west to east-north-east, and the watershed as being 6 miles west of the Qaratash valley; we found, however, that the glen was a short one, only about 3 miles long, and that its general trend was east to west. The watershed here is only $2\frac{1}{2}$ miles back, though farther down it is much more: the system of foothills in all this region is very complicated, consisting of a perfect labyrinth of defiles and rocky ridges. The track over the Achiq Pass to Kauruk Qaraul on the Gez was not difficult, I learnt, and was often used by our own Consular couriers when the Gez was in flood; one more pass after the Achiq Davan, the Kauruk Bel, has to be crossed. The former pass (9,800 feet) is steep for the last 1000 feet, but not difficult for loaded animals. I made a note of it as a possible alternative to the long and arduous "Nine Passes" route.

At the fords above and below the "Narrows" near Saman we found that the water had fallen very considerably during the ten days which had elapsed since we had passed this point on our journey up. The change from summer to winter level in these rivers is often surprisingly rapid, and seldom takes more than ten or fifteen days. Observation is complicated by the diurnal changes of level, which differ for different

streams and at different points on the same stream. At Kaying Bashi (10,400 feet) the rise in the river caused by the action of the morning sun on the glaciers took place between 4 and 5 p.m. in the summer months; at Altunluk the daily flood-water came down in the small hours and had subsided as a rule by 11 a.m.

The next occasion on which we visited this region, though only hurriedly, was in the following April (1923), when we found ourselves at Yarkand in the course of a short spring tour with a fortnight to spare for the return journey to Kashgar. Leaving Yarkand on April 2 we marched up into and across the interesting Qizil Tagh (Red Mountain) region by tracks hitherto unused by European travellers. The peaks of the Qizil Tagh attain 16,000 feet and more, and there are small patches of fir forest at two or three points high up on their north faces. Even this, however, is not quite the extreme limit of conifers in this direction; I was told by Dr. Nyström, the head of the Swedish Mission at Yarkand, that in his search for a summer camp in 1922 he had found small fir woods at a place called Ai Bulung above Koserab on the west bank of the Yarkand River. It would be interesting to know whether any other traveller has found conifers in the Yarkand River valley; none are mentioned, so far as I remember, in any of the books I have read.

Crossing three passes of 10,000 feet or more in one day we descended into the Qinqol valley, which we crossed and camped a mile or two up the hitherto unexplored Chumbuz Jilgha. My object was to find out if there was any practicable pass, other than the Ghijaq, affording access to the Upper Qaratash valley from this side. For safety's sake we sent our caravan round by the Ghijaq Pass to wait for us at Chat, and ourselves pushed up the Chumbuz Jilgha with yaks and a minimum of baggage to a summer pasturage called Kizmak (12,500 feet). We slept the night in the hospitable huts of the local Qirghiz Beg (in this case a lady), and crossed the Kizmak pass (14,000 feet) next morning. We were surprised (and no doubt very lucky) to find no snow on the top, but the descent on the west side into the Qaratash valley was excessively steep and showed signs of earlier avalanches.

That night we camped at the small Qirghiz settlement of Chat (11,000 feet), just above the junction of the Ghijaq and Qaratash streams, where we found our caravan waiting for us and our tents pitched. Six inches of snow fell that night, but next day was glorious, and I was lucky to secure, from a point 1500 feet up the hillside to the east of Chat, a fine panorama not only of the whole Upper Qaratash valley basin, but of the huge ice-clad dome of Qungur II. and several of the Shiwakte peaks, to say nothing of the Chimghan range and the upper mouth of the main Qaratash gorges. My delight at securing a photograph and a set of rays of Qungur and the Shiwakte at *right angles* to those I had already got can be imagined; they have enabled Major Mason of the Survey of India, in his map based on my materials, to plot in a large part

BOZARGA GLEN, YAPCHAN JILGHA, ON ROUTE TO TIGARMAN SU JILGHA

FOLDED LIMESTONE IN UPPER KAYING JILGHA

TIGARMAN SU JILGHA AND KÖK DÖNG

of the unexplored Upper Chimghan Jilgha and the tremendous peaks which enclose it.

Next day we dived into the great gorge. We would very much have liked to spend two or three days exploring the Upper Chimghan Jilgha, a fine wide valley with grand snowy ranges (the Tersöze to the south and the Chimghan to the north) rising 8000–10,000 feet on either side; but in mid-April the summer floods may come down any day, and it was inadvisable to run the risk of being caught in the middle of the gorges.

As it was, the water in the river, which we had to cross twenty-eight times between Chat and Qurghan, was only just low enough at most of the fords for horses to cross with safety. The journey down through the gorges to the mouth of the Kaying Jilgha was a strange experience. The mountain sides towered up 10,000 feet on either side, with occasional hanging glaciers visible far above; the river dashed backwards and forwards between its rocky walls, high up the face of which one could here and there make out the track, a few inches wide and carried from ledge to ledge on the trunks of young fir trees, which in summer forms the only communication between the inhabitants of some of the glens and the outer world. We had hoped to reach Bash Küprük, our old camping-place, by nightfall, but failed to do so owing to the frequency with which we had to unload and reload our ponies among the boulders of the Arasunde gorge; we camped instead a mile below the outlet of the Qaratumush stream, in the dark, on a narrow spit of land boasting a few bushes and small trees but hardly any grazing for the animals. There was light enough as we passed the mouth of the steeply pitched Qaratumush Jilgha to see patches of fir forest away up under the glaciers. Three families of Qirghiz inhabit this wild glen, the only entrance to which, apart from the main gorge, is a razor-edge "pass" 15,000 feet high leading over from the Ghorumde side-glacier of the Kaying Jilgha This "pass" is seldom open before August.

After that day's march the Tügene-tar gorge below Bash Küprük and the remainder of the Qaratash valley was plain sailing, and we marched the 48 miles to Akhtur Bazar in two days.

Two months later, towards the end of June, we left Kashgar for our long-anticipated summer holiday in the Kaying valley. We knew that the water in the Qaratash would be too high to permit of our following our former track all the way, but we were determined to get there somehow, even if it entailed following the toilsome "Nine Passes" trail up the Gez valley and then crossing into the Qaratash valley by the Achiq Pass. As it turned out, we managed to cross the river at its widest and shallowest point in the reach above Altunluk with the help of a dozen sturdy villagers. Thence we kept up the same side of the river all the way to the mouth of the Chopqana Jilgha; the only place where the main river valley had to be left was at the narrows below Saman, which we successfully "turned" under the guidance of a delightful old Qirghiz

aristocrat called Samsaq Bai, whom we luckily met at this point. Samsaq took us 6 weary miles up dry and absolutely barren defiles to the west and across a short but terribly steep "pass" called the Aqsi Davan, over a lofty outcrop of red sandstone 9600 feet high. The last 200 feet of the "pass" consisted merely of a narrow passage pitched at an angle of 30° between perpendicular walls, leading up to a cleft in the rocky backbone. It took two hours to push and haul our animals, including my wife's unfortunate riding-camel Sulaiman, up this passage and to man-handle most of the loads over. On the further side dry nullahs similar to those we had ascended led down to the Qaratash valley, which was joined just below Saman. The whole *détour* occupied seven hours. After this the Chopqana Pass, which we crossed next day (thus avoiding the now impassable Tügene Tar), presented no difficulties.

Arrived at Kaying Bashi, we camped for three weeks on a sheltered Alpine meadow commanding magnificent views of forest and river, towering crag and pale green hanging glacier, wide flower-spangled pastures and thickets of juniper and barberry. The profusion of Alpine flowers was wonderful, and we did as much amateur botanizing as our total ignorance of botany permitted; in the course of our visits this and the following year, we pressed some thirty-seven varieties and obtained the seeds of seven or eight; my wife also painted most of the more striking kinds. This small collection has been examined by Mr. W. B. Turrill, of the Kew Herbarium; his comments will be found at the end of this paper (Note II.). To a layman, the striking thing about the flora of the Kaying and neighbouring valleys is that it is of a distinctly Central Asian rather than of a Himalayan type, although the valleys in question are only about 180 miles as the crow flies from similar regions of Northern Kashmir, the flora of which is, I believe, Himalayan. Of the thirty-seven varieties brought home by us, seventeen are confined to Central Asia, thirteen are found in the northern temperate regions of Europe and Asia, but not in the Himalayas, and only seven are common to the "Alps of Qungur" and the Himalayas. The flower that interested us most of those we found was a sweet-smelling kind of stock which only grew in small isolated patches among the loose stones of glacier moraines between 13,000 and 14,000 feet in elevation, near the highest limit of vegetation; this has been identified as *Parrya flabellata Regel*, previously found only in the Tien Shan. One of the specimens of *Astragalus* we found has proved to be a new species, allied to *A. Alpinus*, but with calyces longer. The conifers of the region are also those of the Tien Shan and not of the Himalayas; with the exception of the small patches of fir forest mentioned above as existing in the Qizil Tagh and at one or two places in the Yarkand River valley, they mark the extreme south-eastern limit of the Tien Shan firs. So far as I know, no fir forests exist in the whole of the Kunlun system.

We saw a great deal of our Qirghiz friends, not only the seven families

who lived in the Kaying Jilgha, encamped for the summer on another meadow about 1000 feet above ours, but those of neighbouring glens who came flocking to see us. My wife gave a tea-party for the ladies, to which women carrying babies came over dizzy passes and through roaring torrents; but they swarmed round her even more eagerly for medicine, the appetite of the Qirghiz for which is insatiable. We also fed the men heavily on boiled sheep and their own indigestible barley bread and sour cream, and spent hours talking to them in their huts. I was thus able to note down a certain amount of information regarding their manners and customs, folklore, mode of life, and social organization. But my chief concern was always to find a way out of the valley to the east or south, which would enable me to map and photograph the eastern face of Qungur and the Shiwakte. The only pass of any kind that existed, I found, was one called the Kepek at the very head of the Kaying glacier to the south-east of Shiwakte I., leading over to a side valley of the Chimghan Jilgha called Aghalistan. The idea of getting by this route into the Chimghan Jilgha at last made me very anxious to cross the Aghilistan pass, but from personal reconnaissance and inquiries from the Qirghiz I found that it could not be crossed even by unencumbered climbers until August, when the worst of the ice and snow had melted off it. As our visit could not be prolonged after July 15, I was obliged to postpone any attempt to cross until the following summer. The daily clouding over of the sky in the afternoons and the frequency of rainstorms rendered regular survey operations at high altitudes almost impossible; but I managed to climb to the top of the knife-edged ridges which enclose the valley at two points, each time after one or more preliminary failures. The first occasion on which I was successful was when, starting at 4 a.m. with Sangi Khan and two Qirghiz, I reached at noon Stn. IV. on the Sarigh Yon ridge 5200 feet immediately above our summer camp. From this point, where the thick snow cornice literally overhung the Tigarman Su valley on the further side, I obtained a magnificent view, which I photographed right round from north-east to north-west, only the northern quadrant of the horizon being hidden by the mass of Kök Döng above me. I also took a very useful set of rays to large numbers of peaks with which, thanks to the panoramas I had taken from Kaying Beli, Nichke Qir, and Chat, I was becoming familiar. I was greatly disappointed to find that the clear view of the whole eastern face of Qungur which I had confidently expected was still denied me; all except the top of the long massif was hidden by the 17,000-feet ridge right opposite me on the west side of the Tigarman Su Jilgha. Part of the Shiwakte range, again, was hidden by the Sarigh Yon peak * quite close to me on the south and some 700 feet higher, but I got a most

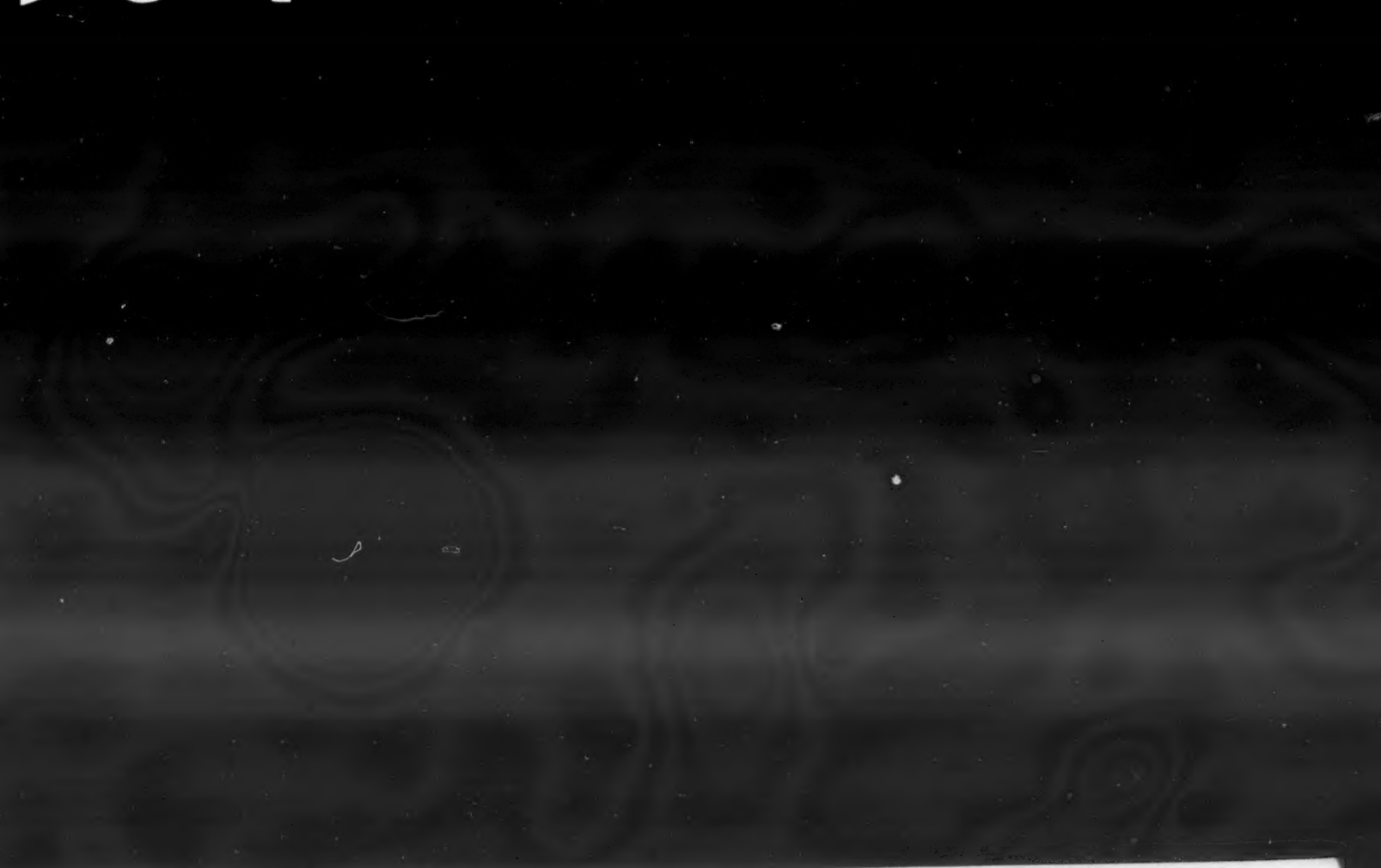
* I would very much have liked to climb this, and would have got a far better view of Qungur and the Shiwakte from it, but the snow on the topmost arrête was by midday dangerous.

striking view, which I telephotographed, of three of the peaks afterwards identified as Shiwakte I. (19,400 feet), IIIa. and III. (20,400 feet) respectively. I was also interested to see, far below me in the depths of the trough-like Tigarman Su Jilgha, part of a considerable patch of fir forest.

The second occasion on which I attained a commanding position was after a 6000-feet climb (the first half of it with the help of yaks) to the top of the razor-like Zumurrat ridge. I first tried this climb from the west, *i.e.* from the main Kaying glacier, but was brought to a standstill by unscalable crags at 14,500 feet. I next ascended with yaks the very steep and trying icefall of the Zumurrat glacier, and then on foot struck up a 2000-foot couloir on the east side of the ridge; this time Sangi Khan and I (not the Qirghiz guides, who collapsed) climbed within 500 feet of the top, but were held up by dangerous snow in the couloir. A week later, the melting of the snow having progressed rapidly, we tried again with a couple of tougher Qirghiz. This time we reached the col, which carried a tremendous cornice of snow, at 1 p.m., and were rewarded by the finest mountain view I have ever seen. The whole of the Shiwakte group, glittering like colossal icebergs clothed with hanging glaciers thousands of feet high, stood right opposite me to the west from 4 to 6 miles away. Again Qungur was almost entirely hidden, this time by the Shiwakte, but enough of the top of Qungur II. was visible for me to get a most useful ray on to it. Far away to the south-west I saw a high snowy ridge which I afterwards found to be part of a range 22,000 feet high on the south side of the upper Chimghan Jilgha, opposite Qungur II. Between me and the Shiwakte group was the row of jagged ice-clad peaks at the head of the Kaying Glacier, which I named the Aghalistan Mountains from the name of the valley on the other side of them; of the two well-marked cols between the chief massifs only the right-hand one, the Kepek Pass, is possible.

Coming down I had a somewhat alarming experience: crossing a small branch of the main couloir filled with ice, my foothold gave way and I shot down like an arrow from a bow for about 40 feet, landing quite comfortably in the middle of the deep snow of the main couloir, but receiving some slight bruises on the way. I might, of course, have started an avalanche; this would have been serious the week before, but now there was not enough snow to make a dangerous avalanche; two came down the couloir later in the afternoon, but they were not very alarming affairs.

Besides these major climbs, my wife and I reconnoitred on yaks the Torbashi, Ghorumde, and main Kaying glaciers, mostly up the lateral moraines, the going on which was sometimes very bad. The Ghorumde glacier valley is typical of the region; you follow the stream up among scattered clumps of fir and find unexpectedly that more than half of it comes out of the ground from the midst of a fir coppice at the foot of



Qungur II.

Qungur I.

QUNGUR RANGE, LOOKING SOUTH-WEST FROM AQSA

Chimghan Jilgha.

SHIWAKTE GROUP, LOOKING SOUTH-WEST FROM STATION V, 16,200

Gez Dara.

ROM AQSAI DAVAN, 9400 FEET. 75° 40′ E., 35° 53′ N.

Peak IIa. Peak II. Peak III.

ON V, 16,200 FEET, ON ZUMURRAT RIDGE. 75° 31′ E., 38° 36′ N.

Kepek Pass.

TELEPHOTOGRAPH OF SHIWAKTE GROUP FROM SARIGH YON

TELEPHOTOGRAPH OF ZUMURRAT GLACIER FROM SARIGH YON

CHIMGHAN I. AND ZUMURRAT FROM SARIGH YON

CROSSING KEPEK PASS

HEAD OF KAYING GLACIER AND KEPEK PASS

KAYING GLACIER FROM TOP OF KEPEK PASS

the ancient terminal moraine, which rises steeply above for 1000 feet or more covered with Alpine flowers and juniper scrub. At the top of the rise are pastures with two or three Qirghiz huts, and away behind for miles stretches the glacier-filled valley up to the almost perpendicular ice-clad backbone of the Chimghan range.

A word here on the glaciology of the region. My researches on this subject are confined to a perusal of the appropriate section in that immortal work 'Hints to Travellers,' but the veriest beginner could say with some confidence that all the main glaciers I examined under the eastern flanks of Qungur and Chakragil are in full retreat. In most cases ancient terminal moraines could be clearly traced far below the present glacier-foot, and the "toes" of the glaciers themselves were generally shrunk to a remarkable extent. The most striking instance of this was in the case of the great Oi Tagh glacier among the Alps of Chakragil.

When we left Kaying Bashi this time we sent the caravan with our riding-horses straight to Saman, borrowed some yaks, and spent two nights as the guests of our friend Samsaq Bai, at his *aq-ois* pitched 12,000 feet up at Bozarga, on the southern slope of the Zor Qir ridge. The march to this place was an arduous but extremely interesting one. After crossing the Chopqana pass, instead of descending the glen of that name we kept round to the left and traversed for several miles the steep pine-clad northern face of Yelpakhtash, the three great crags of which, 13,000–14,000 feet high, towered above us on the left. In some places the trail crossed unpleasant rocky outcrops, in others the muddy tracks of recent landslides, where the whole mountain face, forests and all, seemed in a state of unstable equilibrium; elsewhere again the path, level and quite well engineered, led through pleasant forest glades for all the world as if we were among the Simla Hills. At the beautiful alp of Yapchan, of which we made a careful note for future camps, the path suddenly dived into the depths of a gorge and then crawled up an apparently impossible cleft in the great pine-crowned red sandstone cliffs of Bele Tök, 1500 feet high and very nearly perpendicular. We seemed at one point to be in a perfect *cul-de-sac* with cliffs literally overhanging us on three sides; but Samsaq led us up to a ledge, invisible from below, along which we traversed the cliffs to the left and found ourselves in a steep and narrow but comparatively straightforward gully. Further up we came to masses of wild rose and clematis with clumps of fir and a spring of clear water, until at last, 2000 feet above the bottom of the Yapchan gorge, we saw the huts of our old guide and his large family in front of us on a grassy knoll.

Hearing that there was an easy pass, the At Bel, quite close to us leading over Zor Qir into the Tigarman Su Jilgha, I resolved to reconnoitre it; but that night a wild storm of sleet and rain came on which continued for twenty-four hours and kept us close prisoners in our

hut the whole of the next day. The following morning, however, it was brilliantly fine, so before leaving for Saman we climbed to one of the summits of the Zor Qir ridge. From this point, 13,000 feet high, I obtained useful rays to the magnificent Chakragil massif, to Qungur II., and, no less important, straight down the lower reaches of the Qaratash to the Akhtur oasis; but I was disappointed once more in my expectations of a view of the eastern face of Qungur, for the snowy ridge dividing the Tigarman Su from the Qurghan Köl Jilgha hid all but the very top of Qungur II., while the vast mass of Kök Döng shut out the whole view from south-west to south-east.

Next day when we crossed the Aqsai Pass from Saman with our caravan (a much easier task from the south side than from the north) it was again brilliantly clear, and I obtained from the top of the ridge a very good telepanorama of the whole Qungur massif. The picture ought to include the Shiwakte group, which looked most impressive with its sheaf of needle peaks; but here the evil genius of the photographer stepped in, and I fogged the fourth and last plate of the telepanorama by failing to replace the dark slide of the plate-carrier firmly before removing the plate from the camera. This view of the Shiwakte would have been invaluable for survey purposes, and I regretted its loss more bitterly than that of any of the numerous pictures I lost through carelessness or ill luck.

The following summer (1924), though we expected to be leaving Kashgar for good early in September, we managed to work in a last fortnight among our beloved "Alps of Qungur" in July-August. This time we decided to make first for the Yapchan Jilgha before going to Kaying, as I was anxious to reconnoitre from it the Tigarman Su Jilgha and possibly beyond. Two days were delightfully spent among the pines and amazing riot of flowers of the beautiful Yapchan alp, opposite the magnificent red cliffs of Bozarga and Bele Tök.

Then with an irreducible minimum of retinue and baggage carried on yaks we climbed once more the secret track to Bozarga and crossed the At Bel pass (12,000 feet) behind it. Descending grassy slopes for 2000 feet we found ourselves at the prosperous-looking encampment of Oi, the summer headquarters of the "Nasir Beg," * of the Tigarman Su Jilgha. Here, to our surprise, we were told that we were no longer in the Yangi Hissar district but under the jurisdiction of the magistrate of the Chinese Pamirs at Tashqurghan, eight marches away. The Beg did his best to make us stay the night with him and go back next day without venturing down into the wild Tigarman Su Jilgha, the path to which he described as very difficult; but finding that we were determined, he did his best for us and lent us six fresh yaks for the onward journey in place of our tired ones. The track proved narrow and up-and-down but not dangerous, and two hours later we topped the last

* A kind of minor headman subordinate to the Beg of the region and responsible to him for the revenue of one *jilgha* (valley).

col and looked right up the deep trough-like valley of the Tigarman Su Jilgha (so called from an old mill (*tigarman*), near which is a shrine). A mile further we came to fields of meadowsweet and the first tall firs, and were met by the old headman of the tiny Kirghiz community (three families) whose tents were pitched in a clearing in the thick forest beyond.

We stayed here three nights, but were unable to do much as it rained nearly the whole time. One of my objects had been to climb the Dilbagh "pass," a 13,000-feet col leading over to the Qurghan Köl Jilgha, another large unexplored glacier valley of Qungur; from this col I hoped at last to see the inner arcana of the great range. But when we tried it the first morning, down came the clouds and we had to turn back halfway. As for the peaks at the head of the Tigarman Su Jilgha, of which I had hoped to obtain a close view, they never cleared of cloud at all. However, the valley bottom and glacier foot which we explored were well worth close examination, and the Qirghiz were an exceptionally friendly and interesting community. A striking feature of the valley was a flood of shell-pink water which gushed out of "caverns measureless to man" at the foot of the forest-clad terminal moraine of what must have been a vast glacier filling the Tigarman Su valley in ancient times. We found the source of the pink colour 2 miles higher up, where at the foot of the existing glacier we discovered beds of red clay over which a strong stream flowed from the glacier for 100 yards before disappearing into the earth.

Another feature of the jilgha is the abundant evidence of the presence of copper. I was told, indeed, that a rich vein of copper ore used once to be worked in a terrifying and barely accessible cleft high up on the north-west face of Kök Döng, but that the working had been discontinued twenty years ago for fear of the military authorities hearing of it; this would have meant the mine being taken over and the Qirghiz forced to work in it for the benefit of the military authorities, who in Kashgaria regard all mineral rights as their monopoly.

There is absolutely no exit from the upper part of the Tigarman Su Jilgha, nor can it be reached in summer from the Gez defile, as the lower course of the stream lies through a deep and narrow gorge impassable in the high-water season. The only access to the valley is by the way we came, that is to say, up the Chopqana Jilgha, across the upper Yapchan J. (the lower gorge of which is also impassable) and over the At Bel Pass; and that is not possible for loaded ponies, only for yaks. Nor would it be possible for a stranger to find the way up to the At Bel without the guidance of the Qirghiz.

On our return to the Yapchan alp, where we had left our tents, we went out of our way to visit Samsaq Bai and his clan, who were encamped this year just behind the fir-clad crest of one of the great red precipices of Zor Qir. A grassy ridge dotted with neat clumps of fir and juniper, very much like a well-laid-out park, jutted out over the Yapchan valley,

and on this the huts were pitched ; the grazing all round was excellent, but the place had one drawback in that the unfortunate ladies (who do all the hard work in a Qirghiz camp) had to descend 600 feet to the spring in the Bozarga glen for their water.

After this trip we had only eight days to spare for Kaying Bashi, where we camped once more at the lovely alp below the forest. Only four of our eight days were fine. On one of these I climbed *viâ* the Tor Bashi glacier to the top of the knife-edge ridge at the head of the Tigarman Su glacier. Here, at 16,100 feet on a south face, there was still a great deal of soft snow, and with only a Qirghiz boy to help me I had great difficulty in reaching the top of the cornice. I was armed only with a prismatic compass and my film camera on this occasion. With the compass I obtained some very useful angles on to some of the mountains on the other side of the Chimghan Jilgha, which appeared above the peaks of the Aghalistan range, also down the Tigarman Su Jilgha. The latter enabled me to fit my plane-table sketch of Tigarman Su on to the rest of my map. With the camera I secured a fine picture of the ice-clad peak of Shiwakte I. (19,400 feet) piercing the clouds right opposite me.

The only important piece of work I managed to do during this all-too-short visit was the crossing of the Kepek Pass into the basin of the Chimghan Jilgha. Only now, in the first week of August, did the Qirghiz pronounce the pass to be sufficiently clear of snow for a crossing to be attempted. Even so, the col was so steep for the last 1000 feet and so filled with glacier ice that there was no question of yaks going up it. Accompanied only by Sangi Khan and three Qirghiz hunters, I left my wife in camp for a night by herself and started at 5 a.m. with a supply of cold food and Bovril, my two cameras, a sleeping-bag with a blanket, pillow, etc., in it and my plane-table and instruments (including clinometer and hypsometer) tied up in a sack. This made two light cooly-loads. We did the first 4000 feet on yaks, and then left them to graze on the highest pastures of the Kaying glacier while we attacked the col. On our left ice-slopes at angles varying from 45° to 60° (measured roughly with a protractor) came down from the precipices of Aghalistan Pk. 1 to the very foot of the lower cliffs of Shiwakte I., along which we had to crawl the whole way up. In several places steps had to be cut across tongues of ice running up into clefts in the cliff, and the loads had often to be sent up from hand to hand over difficult bits. Shortly after ten we at last reached the col, and saw away to the left an array of peaks which I afterwards found to be those to the south of the Chimghan Jilgha and its tributary the Tersöze. The Shiwakte peaks were hidden by a jagged black ridge like a row of teeth coming down from Shiwakte I. I spent two hours on the flat top of a boulder taking a complete set of rays and some pictures, and also boiled the hypsometer, which gave a height of 15,230 feet. During this time it unfortunately clouded up,

SHIWAKTE PEAK I. FROM COL ABOVE TIGARMAN SU GLACIER

SHIWAKTE PEAK III. FROM AGHALISTAN

and the Shiwakte group was completely hidden when we descended a small glacier on the south side of the pass and joined, at 13,000 feet, the huge Aq Tash glacier. This took some time, as I made a careful plane-table sketch of all I could see as I went along. Further down we were met by some Qirghiz, who were astonished to see us, but led us hospitably to their two huts and sent word to their headman, Sayat Beg, at his encampment in the main Chimghan Jilgha. This man was very helpful when he came up and gave me a lot of information. Among other things he told me that the Chimghan Jilgha and its branches are rated for revenue purposes at sixty households *; that there are no fir trees in any of them; that the only possible outlet to the Pamirs is over an exceedingly difficult pass, worse even than the Aghalistan, at the head of the Tersöze Jilgha; and that the name "Shiwakte" is used by the Qirghiz of the Chimghan J. for something—whether mountains, pastures, or what I could not quite make out—at the head of their valley.

Owing to the rain and a bad headache I did nothing more that day, and went to sleep at nine on the floor of one of the huts. I was up again at four, and started back for Kaying Bashi at six. I was rather anxious about the weather and afraid of being cut off on the wrong side of the pass, perhaps for weeks, by bad weather and heavy snow. Luckily it had cleared up in the early morning, and though it clouded over again afterwards I was able before it did so to complete my plane-table sketch and secure some fine pictures of the magnificent Shiwakte group, the peaks of which stood round the upper Aghalistan valley in a semi-circle. Never shall I forget the steepness of their sides nor the terrific hanging glaciers that depended from them like vast frozen waterfalls thousands of feet high. The latter feed the Aq Tash (white rock) glacier, so called by the Qirghiz from its remarkable serac, which is visible from a great distance.

Our descent of the pass on the return journey was somewhat exciting. It was warmer than the day before, evidently banking up for heavy rain, and the ice was very soft. The steps we had made the day before had melted, and it was difficult to cut new ones; rocks loosened from the cliffs above came down frequently and had to be dodged; nor was it

* The other divisions of the Qaratash Valley are as follows:

Qaratash, i.e. the main valley above Chimghan Ayaki, 60 households.

Khan Terek, i.e. the main valley and its branches below the big gorge, including Kaying, Chopkana, Yapchan, etc., 30 households.

Terek Kichik (among the mountains on the east side of the Karatash), 100 households.

The revenue paid by the Chimghan Jilgha with its (nominal) 60 households is as follows:

Four *saghins* of cheese, *i.e.* the output of four yak cows in a year; this can be commuted for four *charaks* (1 charak = 20 lbs.) of barley flour.

Forty ropes of camel-hair.

A hundred *charaks* of flour.

Ten yaks or ponies to be lent for transport whenever required.

safe to avoid them by going out on to the steeply pitched glacier, because the thin coating of flat stones and frozen snow over the crevasses might now be insufficient to bear one's weight. As it was, Sayat Beg, who at my request came over with us to investigate some complaint of the Khan Terek Qirghiz, had a narrow escape; he was just in front of me as we filed across an arm of the glacier, when he suddenly disappeared up to his armpits. The *débris* of flat stones which lay on top of the ice formed a support which prevented him sinking further, and we soon fished him out; but, peering down into the hole he had made, I noticed with a slight shudder that Sayat's legs had been dangling over a crevasse at least 20 or 30 feet deep. Near the bottom of the steep part we had to jump off the edge of the glacier on to a steep slope of loose stones, and in doing so started a stone-slide which plunged *under* the snowfield we had just left and went on roaring away underneath for a long time. However, we soon found ourselves safely on the flowery moraine of the main Kaying glacier, where by arrangement a Qirghiz lad was waiting for us with the yaks.

This was the last of my attempts to map the "Alps of Qungur" from the side of the Qaratash Valley. On the way down from Kashgar to India, however, I made an effort to secure a valuable cross-view of Qungur and the peaks at the head of the Tigarman Su and Qurghan Köl Jilghas from the north. On the top of Zor Qir in July 1923 Samsaq Bai had pointed out to me a pass, on the north side of the Gez between the Chakragil massif and Sargalang, called the Arpa Bel. He told me it was regularly used by the local people, and led over from the Gez river near Gez Qaraul to the Oitagh Jilgha, which he said was a very fine valley with fir woods and rich pastures and many inhabitants. As the pass was free from snow and promised the above-mentioned cross-view of Qungur and the Shiwakte, and as no European so far as I knew had visited the forests of the Upper Oitagh valley, I decided to explore it on the way down to India.

This is not the place to describe the remarkable Alpine region we found right under the 14,000-feet precipices of Chakragil—different from but quite as fine as the Alps of Qungur—nor the new alternative route we discovered connecting Tashmalik with the bridge at Gez Qaraul; suffice it to say that we were denied the view of Qungur we had hoped for from the Arpa Bel, for throughout the ten days we were in the Oitagh region the atmosphere remained persistently thick with the fatal dust-haze of Kashgaria.

Marching up the Gez Dara we emerged on September 15 from its terrific gorges, and two days later were camping on the shores of Little Qara Köl in perfect weather. We spent four days in this neighbourhood, during which I visited several of Stein's chief survey stations and took rays from them to the salient points of Qungur and Shiwakte, as well as a number of photographs. My object was to

identify from the opposite side the peaks and ridges I had surveyed from the north-east. I had no difficulty as regards Qungur, but was somewhat at sea as regards the Shiwakte group. None the less, the materials I obtained from this side turned out afterwards exceedingly useful.

On arrival in India at the beginning of November I at once got in touch with the Survey of India authorities, who asked me to take my maps and other material to their Drawing Office at Simla. Here the officer in charge was Major Kenneth Mason, R.E., who has made the cartography of the Pamir region his own. He took the greatest interest in my amateur efforts, which he treated much more seriously than I had expected, spending four whole days on taking over every scrap of my material, plane-table sketches, panoramas, sets of rays and all, and discussing the whole region and the problems connected with it at great length. The amount of work he put into it then and afterwards will be seen from the map and memorandum he has produced specially for this meeting of the Society, and I am more than grateful to him.

NOTES ON THE COMPILATION OF MR. C. P. SKRINE'S TOPOGRAPHICAL MATERIAL IN THE NEIGHBOURHOOD OF THE QUNGUR MASSIF

Major Kenneth Mason, R.E., Survey of India

The material available for the compilation of Mr. Skrine's map consisted of (*a*) Plane-table rays drawn from various points; (*b*) Rough plane-table sketches; (*c*) Enlargements of photographs; (*d*) Clinometer readings to various points; (*e*) Route reports; (*f*) Verbal descriptions. Of these, the greatest use has been made of (*a*), (*b*), and (*c*).

The whole of the area falls in sheet 42 N. In this sheet are only two class A points (fixed by the Pamir Boundary Commission), and no rays were available to these. Of the class B triangulation, that of Deasy observed from the south, and that of Stein based on this work are the most reliable (see *Memoir on maps of Chinese Turkistan and Kansu*, by Sir A. Stein). The first basis of the map is therefore the positions of Little Qara Köl, Subashi, and Shamalda in the neighbourhood of Little Qara Köl lake, and of the peak Qungur I., 25,146 feet, fixed by Stein.

In panoramas IXa., IXb. of *Mountain Panoramas from the Pamirs and Kunlun*, Stein shows the whole south-western face of the Qungur Massif. (These panoramas are reproduced as 3 A and 3 B in the Memoir quoted above.) Comparing the outline of this with the telepanorama taken by Skrine from Kashgar (and with another from Aqsai Davan), almost exactly from the opposite direction, it is possible to identify in both pictures the following points; PK 2/42 N, PK 3/42 N (Chakragil, 22,070, and 21,480); the Gez defile; the whole of the Qungur ridge from this defile to some 6 miles east-south-east of Qungur I. Beyond this point however the outline of the distant mountains from the two positions is no longer the same. The mountain I have shown as Qungur II. is half hidden in Stein's panorama by a great spur sent out in a S.E. direction from Qungur I.; while in Skrine's panorama the highest point is almost, if not quite, hidden by the great dome-shaped massif of Qungur II. itself.

From Little Qara Köl, Qungur II. looks insignificant beside Qungur I.: from Kashgar, Qungur I. looks insignificant beside Qungur II.

It is now possible to examine the observations made from Kashgar to what must have appeared the highest point. Deasy's PK 12/42 N and Trotter's PK 15/42 N are, I am convinced, both attempts to fix the highest point of this great dome.

Deasy's position is 38° 39′ 26″, 75° 21′ 37″;
Trotter's „ 38° 35′ 15″, 75° 22′ 47″.

The former assigns to it an altitude of 23,530 feet, the latter, 25,350 feet. Both observers fixed it from approximately the same point, some 70 miles away. From a subsequent examination of Skrine's photographs, I am convinced, Qungur II. presents a dome over 23,000 feet, 6 miles long from N.N.W. to S.S.E., and 4 miles long from N. to S. Not only did Deasy not observe the same point as Trotter, but I do not believe that either observed the same point at each end of their base. With an enormous ill-defined dome such as this, such a mistake is easily possible.

In view of these considerations PK 12/42 N and PK 15/42 N. have been rejected.

Skrine handed me over a most useful set of plane-table rays to peaks from Toquz Aq Bazar, which place he fixed from Kashgar, and another valuable set from Altunluk, of which the position assigned by Stein has been accepted. The rays from these two points combined with those already drawn from the Little Qara Köl stations—all being set on Qungur I.—gave a series of intersections to peaks, shown on the map as the Shiwakte group, and Aghalistan. From these positions it was possible, by means of other rays, to resect the approximate positions of station 4 and station 5, and to make further intersections. The principle was to draw the rays, ignoring Skrine's identifications; then to compare from photographs and see whether the peaks could exist in those positions. In general, Skrine's identifications, in spite of the difficult nature of the ground, worked out extremely well.

Having obtained positions for peaks, these were identified as far as possible with peaks shown on Skrine's plane-table sketches of the ground, which were then adjusted to these positions, and amplified by close examination of the photographs. The detail is fullest on the south side of and at the head of the Kaying Jilgha, and at the head of the Tigarman Su glacier.

A useful panorama from near Chat gave material for the south-western flanks of Shiwakte II. and IIa., and a telephotograph from the same point seems to indicate a wide basin at the head of the Chimghan Jilgha, probably filled by a glacier, and enclosed by the precipitous face of the southern spur of Qungur II. The Qaratumush valley was filled in from photographs taken near its mouth, and from stations II. and IV. The mouth and head of Pitlik Jilgha, the precipitous spurs and ridges bordering it and the Qaratash, were also drawn in from these latter stations, intersections having been obtained to points on the crest from them and from Altunluk. The ground by Yapchan Jilgha and Chopqana Jilgha is mainly from Skrine's sketches, slightly adjusted to new positions.

The north faces of Qungur II. and Qungur I. are from more distant photographs, taken in conjunction with Stein's work. The Oitagh Jilgha, Arpa Bel, Chakragil area is from a small sketch, a rough verbal description, and from route reports.

The ground in the neighbourhood of the Aqsai Davan is based on Stein, altered to Skrine"s notes.

The heights throughout are rough. They are based on aneroid, boiling-point, and clinometer readings.

Qungur I. is the only peak that can be said to be fixed for height.

The height of Qungur II. is based on the following considerations. Deasy's rays to his Pk. 12, if produced to the newly assigned position of Qungur II., give 25,100; Trotter's position is almost the same range from Kashgar as the new position; his height is 25,350: the average of clinometer readings of Skrine from three different points gives 25,200; the height obtained from Sir Aurel Stein's panorama from Qara Köl lake makes it 25,050.

I have assigned 25,200, believing it to be slightly higher than Qungur I.

The remaining heights of Skrine are to the nearest 100 feet, and may be taken to have a probable error of 300–400 feet.

The following alterations have been made in the map of Stein:

(*a*) Oitagh Aghzi at the mouth of Oitagh Jilgha is moved 3 miles south.

(*b*) Langar is moved 3 miles south.

(*c*) Crow-fly distance between Langar and Achiq Jilgha mouth is shortened by 3 miles.

(*d*) Crow-fly distance between Achiq Jilgha mouth and Altunluk is lengthened by 4 miles.

(*e*) Adjustments to position of Chakragil peaks and Sargalang, to fit in with Skrine's plane-table rays. I am convinced these fixings of Deasy from Kashgar, being very acute, admit this adjustment.

(*f*) Insertion of Qungur II. massif.

(*g*) Insertions of Qurghan and Tigarman Su glaciers and corrections of detail.

(*h*) Insertion of detail of Yapchan, Chopqana, Kaying, and Qaratumush Jilghas with their glaciers and peaks.

(*i*) Extension of Terek Kichik and Pitlik Jilghas and the insertion of detail to the south of the latter.

(*j*) Corrections of the direction of the Chimghan Jilgha with the branch Tersŏze Jilgha.

(*k*) Chimghan-ayaki is 1½ miles south and 4 miles west of the position given it by Stein.

Skrine's explorations fill in several important blanks in our knowledge of the eastern flanks of the Qungur massif. They give a very good picture of the "peripheral gorges of the Pamir plateau," and while emphasizing the difficulties of the ground, reveal a certain amount of vegetation and habitation of which we previously had no knowledge whatever. Separate communities living in the different jilghas can only communicate with each other by difficult passes, and frequently such intercourse is interrupted altogether.

One of the outstanding features of the exploration is the further evidence of the existence of Qungur II. Its great featureless dome has been the cause of uncertainty for years. Its height is not yet settled, but we know now that it competes with Qungur I. for the post of the highest point of the Pamirs.

NOTE ON THE PLANTS COLLECTED BY MR. SKRINE

W. B. Turrill, M.Sc., F.R.S., The Herbarium, Kew

The collection, though small, indicates that the flora, taken as a whole, is distinct from that of the Himalayas and belongs, indeed, to the Central Asian Region. The most striking feature is the number of plants limited either to

Turkistan or to this country and the immediately surrounding districts. These Central Asian endemics give the flora a facies of its own, and, since they are often very distinct species, suggest a long period of uninterrupted floristic development. On the other hand, it is interesting to note the occurrence of several species which have a very wide distribution over the whole of the North Temperate Regions. It is impossible to suggest the locality of origin of these from a study of their present distribution alone.

Before the paper the PRESIDENT (the Earl of Ronaldshay) said: Our lecturer this evening, Mr. Skrine, in the course of his official duties as a member of the Indian Political Service, has been fortunate enough to obtain opportunities of visiting an absolutely unknown piece of Central Asia. Mr. Skrine, when the war broke out, found himself a member of the Indian Civil Service, and, being active, enterprising, and patriotic, he made strenuous endeavours to join His Majesty's forces. Circumstances preventing him from doing that, he did what seemed to him to be the next best thing with a view to getting to the scene of action, that is to say, he joined the Indian Political Department, and in that capacity he first went to Eastern Persia, where he had many chances of studying that part of the country during the war. Subsequently he was sent as our representative to Kashgar, and being anxious to do what he could to further the cause of geography he obtained permission to visit the mountains of Qungur, the meridional chain which lies from north to south between the main systems of the Himalayan Mountains and the Tian Shan; and it is this hitherto unvisited range that Mr. Skrine is going to describe to-night. I might add that he has a long tradition of Indian service behind him, for he is the son of an eminent member of the Indian Civil Service who, as I happen to know from personal knowledge, is still remembered with feelings of affection by the people of Bengal. Our lecturer this evening is also an extraordinarily competent photographer, and he will be able to show us views of these unknown mountains and valleys in the heart of Central Asia which have been described to me by those who have already seen them as some of the finest photographs of mountain scenery which it is possible to see. We look forward, therefore, with feelings of most pleasurable anticipation to Mr. Skrine's lecture, and I now have pleasure in asking him to proceed with his narrative.

Mr. Skrine then read the paper printed above.

The PRESIDENT: Is there any one present who has been in the neighbourhood of the country we have seen to-night? If so, I would be glad if any volunteer would say a few words. . . . It appears that there is no one present who has any personal knowledge of the neighbourhood. The thing that struck me about the photographs, a point which Mr. Skrine himself emphasized, was the extraordinary similarity between the valleys of this hitherto unvisited meridional range and the valleys of the Tian Shan Mouutains which lie very much farther north. The part of the Tian Shan which I know lies in the neighbourhood of Kuldja on the Chinese frontier, which must be some 200 or 300 miles north-east of the actual mountains of which Mr. Skrine has shown pictures this evening, and the pictures which he showed us, both from the contours of the mountain, the flora, and even from the people themselves, might have been taken in the Tian Shan round about Kuldja. The mountains there are inhabited in the same way by those wandering Kirghiz tribes, and throughout the valleys which I know there are the same trees which Mr. Skrine

described as the Tian Shan fir, which is much like the Wellingtonia in appearance. That is very interesting, because this range described to-night is really much nearer to the Himalayan system, and it must be, as Mr. Skrine ventured to explain, that this curious characteristic is due to the fact that there is between the Himalayan and the Kungur range such an enormous wall of mountains as to prevent the interchange of flora. I think you will agree with me that what I said with regard to Mr. Skrine's photographs before he showed them to us was none too high praise. They do indeed constitute a most magnificent series of mountain photographs, and they show, above all, that Mr. Skrine himself took an immense amount of trouble in selecting the sites from which to take the different views. Mr. Skrine has also shown that, in spite of the fact that his early training in map-making consisted merely in plotting out a nine-hole golf course in the United Provinces, he must have proved an extraordinarily apt pupil, because the map which he showed us to-night, though it was compiled by a member of the Survey of India, was all based upon the excellent material which Mr. Skrine himself provided. And as long as Englishmen are prepared to spend such leisure as they are able to snatch from their ordinary daily duties in exploring the unknown places of the Earth in the way that Mr. Skrine has shown that he has done, so long, I think, will the English race remain pre-eminent as the pioneers of the world. May I express to Mr. Skrine the gratitude of this audience for the treat which he has given us to-night, and at the same time convey to him our hopes that in the course of the duties which may lie before him in the future he will find similar opportunities for exercising those talents which he has shown us he possesses in so eminent a degree.

UHA IN TANGANYIKA TERRITORY

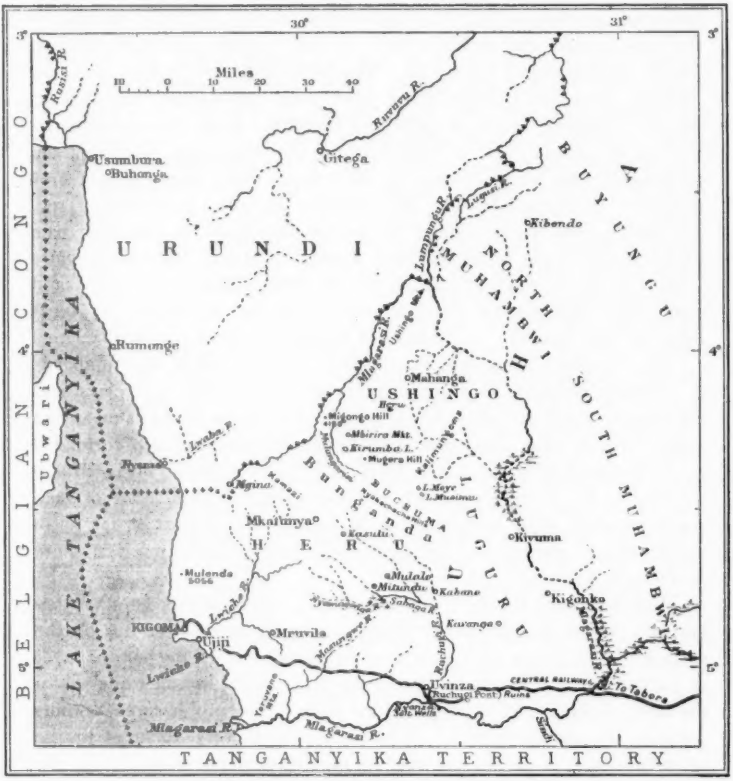
Capt. C. H. B. Grant

UHA lies approximately between 3° and 5° S. latitude and 29° 40′ and 31° 15′ E. longitude, to the north of the Central Railway line, within the administrative district of Kigoma. From 1921 to 1924 I was in charge of the Kasulu Sub-District, and for a time of Kibondo Sub-district also. These Sub-districts comprise Uha, the former being divided into three Sultanates, Heru, Ushingo, and Luguru, and the latter into two Sultanates, Buyungu and Muhambwi. The largest river is the Mlagarasi, which, starting from near Lake Tanganyika, goes northwards, and taking a bend south and west enters the lake some distance below Ujiji. All the waters of the Kasulu Sub-district, except for one basin that drains direct into the Lwiche, and of the southern part of Kibondo Sub-district, fall into the Mlagarasi. Kibondo Sub-district is badly watered compared to the Kasulu Sub-district. There the mountains of Heru are intersected with innumerable perennial streams and rivers of cool, clear crystal water, rising mainly in bare open grassland. These highlands were said to be covered in forest, the haunt of elephant, buffalo and other game, before the advent of the Watussi. Even during

such a dry spell as occurred in 1923, but 6 mm. of rain falling in June, July, and August, none of these rivers failed. Mr. W. Campbell Smith, M.C.M.A., Mineral Department of the British Museum of Natural History, is of opinion "that these rivers have their origin in springs which derive their water from distant sources, and that examination of the ground would probably explain the origin of the springs and show their relation to the large area of sedimentary rocks resting on Archaic rocks below." The pasture cannot be considered good, much of it being coarse grass; but during the drier months stock finds plenty of grazing in the evergreen valleys of the rivers and streams. Stock was undoubtedly introduced by the Watussi, and as regards Kasulu Sub-district is now confined to the mountains of Heru and Bunganda and to two restricted areas in Luguru. In earlier times the mountains of Ushingo and parts of the lowlands, as for instance Masengi, Mitundu, Mulalo, Sabaga, and Kalimungoma, were cattle districts, the cattle having died from rinderpest some time before European administration. The loss of stock caused the people to move, the one-time cattle areas becoming re-forested, and the tsetse has returned. The stock census of 1921 shows for Kasulu Sub-district 19,837 head of cattle, 3603 of which were bulls; sheep 4339, and goats 5079; but there is no doubt that stock was sadly depleted during the years of the Great War, and more especially the sheep and goats.

Sabaga is of peculiar interest; what was, within the memory of natives still living, an open grassy plain dotted with cattle, sheep, and goats is to-day a vast deep papyrus swamp full of hippo, sititunga, crocodile, wildfowl, etc. The Nyamagonga flowed along its northern edge, and a small stream, the Kivogo, flowed somewhere through the centre from the south-west. Only the source remains of the Kivogo, and the Nyamagonga loses itself in this swamp to emerge at the eastern end as the Sabaga. Much of the papyrus on this swamp is floating, and the extent and position of the open water vary according to the wind. On the German map (C. 2) of 1 July 1906 a swamp is shown to the south of Sabaga by name Nyamiyonga, which to-day is merely a depression holding water only in the wet season. Natives can remember this as a permanent swamp, the home of hippo, sititunga, etc. In the Bunganda District of the Sultanate of Heru occur several lakes, the majority of which have no connection with any river, merely lying in wide open depressions, and served only by surface drainage. Several of these are very deep, notably Moye and Muzimu, a man getting completely out of his depth within a couple of yards of the bank, and would appear to be ancient craters. One of these lakes, Lake Kirumba, is shown on all maps as lying in the valley of the Mlagarasi. This is quite wrong, and has doubtless occurred through the similarity of two names, Mulangarisi and Mlagarasi, the former falling into the Mlagarasi near Migongo. The climate must be considered good; even the lower forested country is

by no means unhealthy, and the open grassy highlands which run to nearly 6000 feet above sea-level are as fine and bracing a stretch of mountainous



Sketch-map of Uha, Tanganyika Territory.

This sketch-map is based upon Captain C. H. B. Grant's detailed plane-table survey, which has been re-drawn on the scale of 1/300,000, *and adjusted to fixed points of the Anglo-Belgian Boundary Survey by the Geographical Section of the General Staff, War Office. The map has not yet been published, but a photographic copy can be inspected in the Society's Map-Room.*

The detail for the southern part, along the line of the Central Railway from Tabora to Kigoma has been taken from the map, based upon the plan compiled by the German railway contractors, which was published in the 'Geographical Journal' for November 1924.

country as exists anywhere in Africa, cool on the hottest days and cold with thick mists in the rainy season. The temperature is moderate, and for the twenty-six months from December 1921 to December 1923 averaged, maximum 29·1° C., and minimum 14·4° C., the rainfall for the same period and inclusive of a German record from April 1911 to March 1922 averaged 104·6 mm. The prevailing wind is from the east. Mineral specimens brought home have been very kindly identified by Mr. W. Campbell Smith as dark grey limestone from the Nyakachacha hills in Bunganda; quartz crystals from the mountains of Bunganda, presumably from veins intersecting the country rock; very compact grey dolomitic limestone showing deep solution furrows, chert stained red, and laterite from the hills along the eastern Malagarasi in Ushingo; pale lilac-coloured clayey sandstone from Kamazi in Heru; "diabase," agates from vesicles in diabase, calcareous deposits, pinkish-white clay, and pure white clay mineral like halloysite from the mountains of Heru; light red clay from the "salt licks" of the mountains of Ushingo.

Mr. Campbell Smith remarks: "As far as I can judge, the 'diabase' is probably intrusive in a sedimentary series of sandstones, clays, and limestones, which probably belong to what are known as the Tanganyika Beds. These have been described by F. Tornau, and are correlated by F. Behrend with the Black Reef and Pretoria Beds (Pochefstroom System) of the Transvaal, which is pre-Devonian. This series of sediments extends from just south of Mlagarasi river almost as far north as Ruwenzori, and reaches eastwards from Tanganyika to the west shore of Victoria Nyanza."

With reference to the "salt licks," Mr. MacHinton suggests "that the salt carried in solution by percolating water crystallized out on the surface of the clayey cliffs, and that the beasts eat off the surface layer to get the salt. If this is so, the surface layer might be salt while within the mass of the clay there might be no trace. The problem really wants working out on the spot."* Erosive action is very apparent in the mountains, and is caused not only by the rivers and streams, but by the heavy rainfall washing away the surface soil.

The timber on the whole is small, though large trees are not uncommon. The "Marumba" (Ficus) is found only around the villages or their deserted sites, and provides the native with bark cloth, live fencing, rope, bags, and on the open highlands this tree and the Bamboo are the only firewood available for many miles. The "Misongati" (Pandanus) is found along nearly all the rivers, but is quite a useless timber for bridge work. Both the sweet-scented and non-scented Mimosa (Acacia) exist, the former in Southern Luguru. There is a wealth of flowering plants, among which the various-coloured Gladioli, the purple and white Romulea, and the *Gloriosa superba* are worthy of mention. Banks of fern are seen everywhere. Game is still quite plentiful, and the species found are the

* See also Christy, 'Big Game and Pygmies,' pp 217, 218.

elephant; black rhinoceros; hippopotamus; roan sable, which is confined to Southern Muhambwi; eland; topi and Lichtenstein's hartebeests, the latter not occurring in Kasulu Sub-district; Defassa waterbuck; buffalo; giraffe, which does not occur within Kasulu Sub-district; both forms of reedbuck; bushbuck; sititunga, a common animal in the papyrus swamps; zebra, which does not occur within Kasulu Sub-district; the common duikerbuck; and the warthog and bush pig. Only three kinds of francolin are found, three species of bustard, the helmeted guinea-fowl, two species of geese, and eight species of duck. The common and solitary snipe occur in great numbers during the summer season. Some species are the totems of certain families, and in consequence the meat is not eaten by them. The Watussi do not eat game, though they are not averse to hunting. Sultan Ruhinda of Ushingo and Mtwale Biessa of Bunganda are both keen hunters, but neither touch the meat. Elephant, rhinoceros, and hippopotamus are not eaten by the Waha, and very few will eat the flesh of the buffalo and bushbuck. The roan and reedbuck do not appear to be the totems of any families, and are therefore most generally hunted for their flesh. The totems of Sultans Kanyoni of Heru, Ruhinda of Ushingo, and Kimenye of Luguru is the Ground Hornbill (*Bucorbus cafer*), the "Ugugugu" in Kiha; that of Mtwale Biessa of Bunganda is the domestic dog; of Sultan Kahigi of Buyungu and Sultaness Nyamaliza of Muhambwi, the black ox. Elephant ivory, whether found or shot by a native, lion and leopard skins, and the Bateleur eagle (*Terathopius ecaudatus*) called "Nkona," captured alive or dead, are the perquisites of the sultans, who in the case of the ivory now send it to the Government.

Among the travellers who have visited Uha are Stanley, 1871 and 1876; Wissman, 1882; Baumann, 1892; Ramsay, 1896 and 1897; Rindermann, 1896; Burgt, 1896; Langheld, 1897; Fonck, 1898; Dautz, 1898; and Growert, 1898. Stanley in November 1871, on his way to Ujiji, endeavoured to cross the southern part of Uha, reaching Kabano in Luguru; but owing to the heavy tribute demanded by the chiefs he crossed the Ruchugi and made for Ujiji by way of the forests of Uvinza, not daring to light fires or shoot game until he was clear of Uha lest the chiefs should follow him. In 1876 on his travels from Lake Victoria to Ujiji he kept to the eastward of Uha, and on his map is the note "heavy tribute demanded by kings and chiefs of Uh-a." Stanley therefore saw little of the country, and incorrectly gave the name "Uguru" to the mountains of Heru. Baumann, who crossed northern Ushingo on his way from Urundi to Tabora in 1892, says of the Waha, "They are governed by petty chiefs, and live in small villages." It would therefore appear that he did not meet the Sultan of Ushingo, though his latter statement holds good to-day. I am unable to find that any of the other travellers, all Germans, have left any record of their impressions of the people and country.

Broad roads opened by the Germans, Belgians, and British, with timber bridges, make travelling easy throughout the greater part of the year, though they are in no sense fitted for motor traffic. At Kasulu village a stone bridge crosses the Bogwi. In 1923 a new road was cut from Kasulu to Kigoma round the foot of the mountains, and Commander Kerr reached Kasulu Boma by motor cycle in October of that year in a few hours' riding. This was the first time a motor vehicle had entered Uha. Considerable work has also been carried out on the roads in Kibondo Sub-district, and there appears no reason why the road from Kasulu Boma to Kibondo Boma and thence to Bukoba should not be able to carry light motor transport during the greater part of the year.

The population of Kasulu Sub-district in the census of 1921 was 77,400, and about 130,000 for the two Sub-districts.

The Sultanates are divided into districts under sub-chiefs called Watwale and Wateko. The Sultans are called Mwami, and are all related, being the descendants of the Watussi who came from Ruanda many generations ago. Two tales are told as to how the Watussi reached Uha. One is that, rinderpest having decimated the cattle, they came south hunting elephant, and carried back the ivory to purchase fresh stock from a country farther to the north, probably Uganda and Kenya, and afterwards returned and settled in Uha. The other is that two brothers, Nkanza and Kimenye, quarrelled with their father, and hearing that to the south there was a country without sultans, travelled thence, and settled in Buyungu, Kimenye afterwards moving further south into Kunkanda (the ancient name for Luguru). It seems certain that Nkanza was the forbear of the sultans of Kibondo Sub-district, and Kimenye the forbear of the sultans of Kasulu Sub-district, as both these names appear first in the genealogical trees. There is no doubt that the immigration of the Watussi into Uha was a peaceful one, and they were almost immediately looked up to by the Waha, who accepted them as their super chiefs. Previous to the influx of the Watussi it would appear that the Waha were a purely agricultural race, and that their chiefs were the present Watek, who were more village headmen than chiefs of districts, the Mtwaliate being an innovation of the Watussi, and even to-day many of the more powerful Watwale are Watussi, and several are closely related to the reigning families. The Wateko still have great influence over the people, and have very considerable power. In them is vested the planting and grazing rights, and they are the blood brothers of the Nsatu (python).

In the beginning, Heru, Ushingo, and Luguru were under one sultan, but this did not last long, as the sons who were the Watwale of these districts declared themselves as independent sultans after Sultan Ntale had lost the war against Bigondo of Luguru, and returned to Heru sick, to die soon afterwards. On the defeat and death of Ntale, Ruhinda of Ushingo declared himself an independent sultan, as did Bigondo, who

styled himself Luasa the First of Kunganda (Luguru). After the partition of Kasulu Sub-district into three sultanates, peace appears to have reigned throughout Heru and Ushingo up to the taking over of Uha by the German administration, but in Luguru trouble arose between Sultan Kasuwa (who died in 1921) and his brother Tuki through the machinations of one Tagazwa, a powerful Mtwale, still alive, and relation of the reigning family, who had put Tukin in as sultan and caused Kasuwa to flee to South Muhambwi. Finally the German Government intervened on behalf of Kasuwa, and established a seat of administration at Ujiji. When in March 1921 the British took over Kigoma District from the Belgians, Heru was in a ferment owing to the usurpation of the sultanate by Luyagwa, who was not the lawful sultan. Makwaya (Kanyoni), the rightful heir, was placed in power, and by the end of 1921 comparative peace had been established, to be broken twice during 1922 by faction fights, the final sparks of the unrest caused by the war between the Great Powers.

The Watussi are a tall thin people with Semitic features and square shoulders, but those resident in Uha are not so tall as the Watussi of Urundi. They usually marry only into Watussi families, though natives of mixed blood are not uncommon. Some of the sultans and Watwale have personal bands which are called "Busego." The Waha are an indedendent, cheerful people, much given to conviviality, dancing, and beer-drinking, this latter often leading to personal quarrels and fights; and most cases of murder are done during a state of intoxication and in the heat of the moment. Civilization has touched the people but little, and both Watussi and Waha are very much as they were before the white man first visited Uha. The Missions have had no real influence on them, and very few indeed have turned to Mahommedanism. They still dress as of old, and have little or no need of money, their country producing their clothes, their houses, and their food. Their dress is usually of bark or hide, with copper or brass bangles. Every man carries a spear, and generally a knobkerrie and knife. Bows and arrows are carried only when hunting and at war. In North Muhambwi poisoned arrows are used. Cloth is received in barter, but is worn in exactly the same way as the native-made skin and bark dresses.

Their houses are of the beehive type; some are merely poles set up in an inverted sugar-loaf, and roughly covered with grass; others, especially of the Watussi, are well made and roomy, having the grass laid on in a ridge-pattern over a bamboo frame. The villages are usually surrounded by a "Boma" of "Narumba" and reeds. In the forested areas strong bomas of stout timber are erected as a protection against lions and leopards. The larger villages are divided in compounds within the main "Boma," one being for stock.

Both men and women cultivate the fields and plantations, and the younger people herd the stock. All land is communal, and the individual

only holds a garden or plantation as long as he remains there to cultivate it. As cultivators the Waha are good, tilling the ground deep, and reaping rich crops of mtama, maize, beans, pumpkins, sweet potatoes, tobacco, etc. In the mountains water furrows are to be seen along many of the valleys, and by this means green crops are available throughout the year. The cutting of these furrows has entailed considerable work, and is carried out by the families residing in any particular valley, an amicable arrangement being arrived at as to the use of the water to irrigate each garden. A new-comer pays for the right of tapping the water-race for irrigation purposes, the payment varying according to the amount of work originally carried out on the construction. Rice, European potatoes, and vegetables do well, and wheat and cotton have been experimented with. Many of the river valleys would stand extensive cultivation, as for instance the Mugandazi, parts of the Ruchugi, and that part of the Mlagarasi lying between Muhalulu Mountain and Migongo. The possibilities of Kasulu Sub-district, both from an agricultural and stock point of view, are very great, and it is to be hoped that the Waha will realize the enormous potentialities of the country in which they live.

The industries of Uha, apart from agriculture and stock-raising, are the winning of salt from the surface near the eastern reaches of the Mlagarasi bend, and in the great salt swamp on the eastern side of Kibondo Sub-district; and from the "Ebeberi" grass, which is first burnt and the salt extracted from the ashes; the making of pots, jars, cooking-utensils, etc., from local clay; wooden stools; basketwork of palm and grass; beadwork; copper and brass wristlets and wire bangles and anklets; whistles from hippopotamus ivory; drums; bellows for smelting; bark cloth and bags from the "Marumba"; wearing apparel and purses from hide; salt-carriers from the leaves of the "Mulembera" tree, which are ingeniously woven by bending over the stalk of each leaf, and are sold in large quantities to the Nyanza saltworks; iron smelting and the manufacture of iron implements and articles, as hoes, axes, bill-hooks, knives, spears, arrow-heads, and bells for dancing. Iron is plentiful throughout Uha in certain localities, and old surface workings are frequently seen. The iron is extracted from the ore with the aid of charcoal and native bellows.

In the Sultanate of Heru there are thirty local markets, purely native, where the people buy and sell local produce to each other, such as grain, beans, meat, and bananas, and native-made articles as bark cloth, wire bangles, and iron hoes. Salt from the salt-wells of Nyanza in Uvinza and from surface winning near the bend of the Mlagarasi finds ready purchasers both among the local population and the Warundi, who cross the border to trade. These markets are a very ancient institution, and are free from Government tax, though in some a tribute is paid to the local chief. They do not exist in the Sultanate of

Ushingo and Luguru. Permission to establish a new market is given by the chief, and the place is "blessed" by a native doctor, who buries an offering in the centre of the ground. Later a Marumba tree is often planted on the spot. Numbers of Warundi visit Mbirira market daily to sell hides, cow and palm fat to the Indian and Arab traders, receiving either cash or cloth in exchange. This market and Kasulu are the only two where Indian and Arab shops are found; but whereas the traders of the former depend almost entirely on the hide and fat trade, the traders of the latter do a general store business. In these two villages are also to be found a number of alien natives, who style themselves Swahili; as a matter of fact hardly one is a man of the coast, nearly all being Congo natives. These Congo natives have in most cases arrived in Uha through the Arab slave-raiders. As elsewhere in Tanganyika territory, a certain amount of domestic slavery exists, but it is not very apparent. This domestic slavery was augmented during the famine in northern Ushingo about seven years ago, the people selling their children for a handful of food.

A sultan is never allowed to die, nor is he buried in the ground. When in extremis, he is either strangled or his neck twisted by whosoever is present at the moment. Pandemonium reigns in the village at the death, and every one flees, driving away all beasts and seizing any article they can lay hands on. The Bilu (who are said to be the children of certain slave women) alone remain and take charge of the body, and seize all stock, etc., left behind. A white cow is killed and the skin removed entire, the horns being detached from the skin. The body is placed in this skin with the head in the head of the skin, and the arms and legs in the four legs of the skin. The skin is sewn up, and the whole is dried over fires which are fed with milk. When dry, the body is placed in a canoe-shaped wooden trough, the whole sewed up in a cowhide, and carried to the burial-place of the sultans, and is there placed on trestles, and a hut built over it. On the road from the village to the burial-place all stock passed is captured by the Bilu, therefore the people make themselves scarce on these occasions. When all is over, the chiefs and people return to the village and a new sultan is appointed. The Bilu and the attendants of the burial-place called "Banyongozi" are taboo to the Sultan, who is never allowed to meet them, nor does he ever visit or look upon the place of burial. The sultans of Heru are buried at Kisangi in the Highlands, those of Ushingo are buried at a place of the same name situated on the north-western slopes of Kihinga, and the sultans of Luguru are buried at Mumisanzu, a little way to the north of Kivumba.

The burial-place of the sultans conjures up the "Valley of the Kings" in Egypt, but nothing so ornate and elaborate is to be seen. A more wretched arrangement for the keeping of the bodies cannot be imagined. In the middle of a clump of "Marumba" is found an ill-kept native hut or so. In the hut with the coffin live the attendants. On

one side of the hut is seen the coffin on its trestles, and beneath it the offering to the spirits of the dead. Both the coffin and the inside of the hut is black from the smoke of fires. At Kisangi in Heru only the coffins of Mtale IV. and of Luasa are to be seen; the coffins and huts of the other sultans have long since entirely disappeared, the coffin of Mtale IV. has already fallen to one side, and was leaning against the side of the hut, an example of how completely the Central African native leaves no sign of his existence. The peculiar rites described above are carried out for the sultans only; all other Watussi are buried in the ordinary way within the village.

A newly appointed Mtwale pays for this honour in cattle, from two to five to the Sultan, one to the Sultan's representative, who formally hands over the district, and one or more to be killed and the meat given to the people. Likewise a new Sub-Mtwale pays the Mtwale. The people build the huts of their chiefs, and cultivate the fields of the Sultan. On completion the people receive presents of meat and salt. Though no tribute is demanded by the sultans and chiefs, they accept food-stuffs in the form of presents. Under tribal system the sultans and chiefs hold public courts for the hearing of cases affecting the ordinary life of the people, and fees are paid by the parties. A plaintiff usually opens proceedings by taking a pot of native beer to the chief, and fees are standardized to the value of 3*s*. or 4*s*. for a stock case, a proportion going to the chief hearing the case, and to the man who calls the defendant and the witnesses. Garden or plantation cases are 1*s*. and 2*s*., and are heard by the Mteko or the Mtwale. The Sultan's Court stands as a "Court of Appeal" if either party disagrees with the judgment given. Should it come to the ears of the court that witnesses have been bought or bribed, the court refuses to hear those witnesses. This system will, however, go, now that the Government has established properly constituted native courts. The spear also plays a part in native law, as when the plaintiff wins his case but only receives part of the claim, he places his spear in the ground before the court and people, or he will go to the place of a debtor and place his spear in the ground before his hut, gardens, or stock. Sometimes the plaintiff hands money to the elders attending the court, or gives each a specially cut stick. This custom is obviously to impress the matter on the minds of the assembly. In the settlement of dowry or debt, a milk cow is equal to two bulls, and *vice versâ*. The killing of an elephant or the finding of ivory entails the rite of a sheep or goat being killed over the carcase, and a pot of honey being placed near it. After the lapse of a few days the tusks are removed and taken to the Sultan, to whom they are taboo until this rite has been carried out. In all villages and in certain sacred woods the "Mwiko" or spirits are propitiated by the placing of food and the erection of miniature huts.

In the district of Buchumu in Bunganda, near the headquarters of the Karengi, there exists a pool within a wood called Kikorogwi, the waters of

which are said to be poison to the Watussi and animals, but which is not harmful to Waha. Skeletons of reedbuck and warthog are said to be seen around it, and it is taboo to all. Any person drawing water is liable to be accused of attempting to poison his chief or Mtussi. When any one approaches the tree shakes as in a high wind, snakes appear, and a drum booms in the depths of the pool. Only one white man, a German, has been within this wood, and he fell dead when he struck a tree to fell it with an axe! At least, so the natives say, but they will not point out the exact place to any European. On the top of Mugera Hill, at the southern end of the low range that marches with the eastern Mlagarasi river, is a solitary tree, and it is said that every beehive placed in it is always found on the ground next morning. Sometimes the ropes are left up the tree quite intact, and sometimes ropes and all come down, but are unbroken and uncut!

On the top of Ngoro in the Ushingo Mountains, at a spot where two footpaths meet, three pieces of a stone ring are to be seen. Natives passing the place pluck grass and arrange it carefully around these pieces. They say that originally the ring was whole, and that in a wood close by there exists a stone hammer and other tools of the "mythical" workman. During some part of the year a very large male rhinoceros keeps guard over the ring and drives away any one approaching! Before European Administration and Ordinances replaced some of the tribal laws, the crime of homicide could be punished by the Sultan seizing all the property of the murderer, though none of this property was paid to the family of the murdered person. But more often the murderer paid blood money. The non-payment of blood money more frequently led to vendettas. Robbers and thieves received no quarter when caught red-handed, and were hunted down and killed, the right hand being removed from the body and carried to the Sultan on the point of a spear, the body being left to be eaten by hyenas if the relatives did not bury it. This practice is hard to eradicate, and in 1921 a robber's hand was brought in to Kasulu Boma on a spear-head, the body of the robber being severely battered and covered in spear wounds.

Kihugu is the kingdom, and Kimana God. Some say Kimana is the python, and others a force felt but invisible. Opinion is divided on this point, though to all the python is sacred, and is under the special guardianship of the Mteko, and his attendant satellite, the Maholia or Sabukuru, who helps the Mteko in the apportioning of gardens, etc., to the people. Should an Mteko accidentally kill a python, he gives a present to the Sabukuru, who makes medicine and cleanses the Mteko's person and house. No Muha will voluntarily kill a python. Should he do so accidentally, he instantly reports the matter to his Mteko, taking with him a present, half of which the Mteko gives to the Sabukuru, who then carries out the cleansing process. Witchcraft is largely practised, resulting in false and imaginary evidence being produced before the

courts, adding not a little to the magistrate's ever-present difficulty of sifting the lies from the truth.

I have made a plane-table survey based on points fixed from the Central Railway by Mr. F. Longland, who took the German Railway Map of 1913 as being accurate. The Geographical Section of the War Office, who are very kindly reproducing the map, report that very little adjustment is necessary to correlate the work to the positions recently fixed by the Anglo-Belgian Boundary Commission. The latitudes given on the German map were found to be accurate, though the position of Kinama was found to be too far west. Kinama was the name of a deceased Mtwale, and has therefore been omitted from the map. Luasa, so prominently marked on all published maps, is the name of a deceased Sultan of Heru.

GEOTHERMIC RESEARCHES MADE AT BORYSŁAW

Henryk Arctowski

AFTER several unsuccessful attempts to obtain accurate temperature data at various depths in oil-wells, I have finally adopted a device which is practical and simple. A weight of 1 kilogram lowers a thin steel wire, to which thermometers are attached, and a wheel of 1 metre circumference, fixed on a demountable tripod about 2 metres above the ground, measures the length of wire lowered. For depths of 400 metres or more I use small maximum thermometers of a special construction and an appropriate very short scale. Three such thermometers bound together are sealed in a glass tube. This tube is protected by three springs, slightly bent and fixed at both ends to small aluminium blocks, cut in two lengthwise so that they may be screwed tight to the wire.

The tube containing the thermometers is attached separately to the wire in order that the reading may be promptly made at the moment of the return of the thermometers to the surface. This is necessary because the temperature of the air, during the summer months, is frequently higher than the temperature measured at moderate depths. The thermometers must be cooled again before being lowered.

For small depths, to 400 metres, I also use ordinary thermometers of large dimensions, sealed in thick glass tubes and protected against changes of temperature. These thermometers require several hours' exposure, and are therefore generally left in the well overnight.

When the measurements are made at a greater depth than 1000 metres not more than four sets of thermometers are attached to the wire, while for lesser depths as many as seven measurements may be made in one operation.

With the help of two of my assistants, Stanislaw Zych and Henryk Orkisz, I have already made 824 measurements in 33 wells at Borysław, Tustanowice, and Mraźnica.

The distribution of these wells is shown in the first diagram. Although all of the wells in which measurements were made lie within a radius of 2800 metres, there is a great difference of temperature found at the same depth; for example, the highest measured temperature at 1000 metres was 34°·9, while the lowest was 27°·35. A like difference on the surface, in the annual mean temperatures reduced o sea-level, occurs only at a distance of 900 kms. in a south-westerly direction (Dalmatia) and 1200 kms. north-east of Borysław.

An escape of gas affects the temperatures of a well. Generally the escaping gas, because of expansion, has a cooling effect. A strong escape

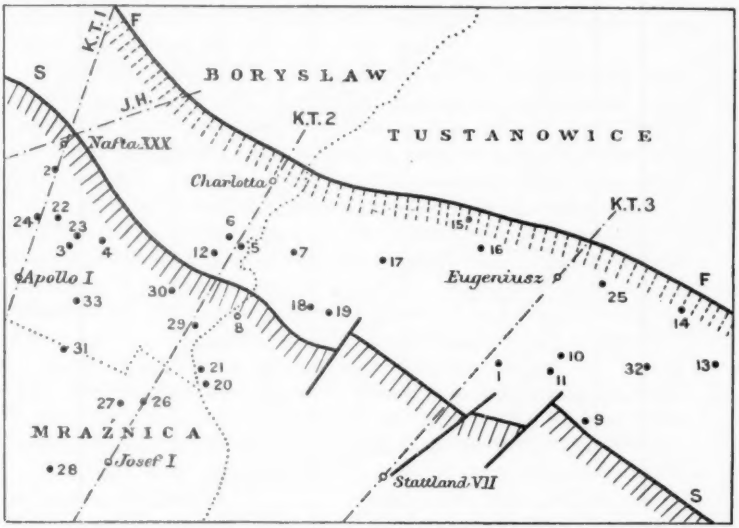


Diagram 1.—Distribution of Wells.

of gas (over 1 m.³ per minute) may however produce just the opposite effect, as has been observed in the Pluto well (No. 10 on map).

In this particular case the gas probably originates at a greater depth than the bottom of the well, and, if so, should be considered as "thermal gas." It certainly cools off at the bottom of the well, where expansion takes place, but remains warm enough to heat the upper parts several degrees above the temperature of the rocks. It is therefore very difficult, if not entirely impossible, to apply corrections to the observed temperatures in order to eliminate the effect of gases, so it is best to work exclusively in wells where there is little or no gas.

On the second diagram the temperatures measured at different depths, in the well Sieghart I. (No. 33), are indicated by dots. There is an escape of gas of less than o·3 cubic metre per minute from the outside

of the tubes. The diagram shows plainly that this gas originates at a depth of about 1230 metres and lowers the temperatures recorded in the well up to about 100 metres above that level. At 1200 metres the observed temperature, 30°·5, is approximately 2°·5 lower than it should be, and since it is less than the temperature recorded 50 metres

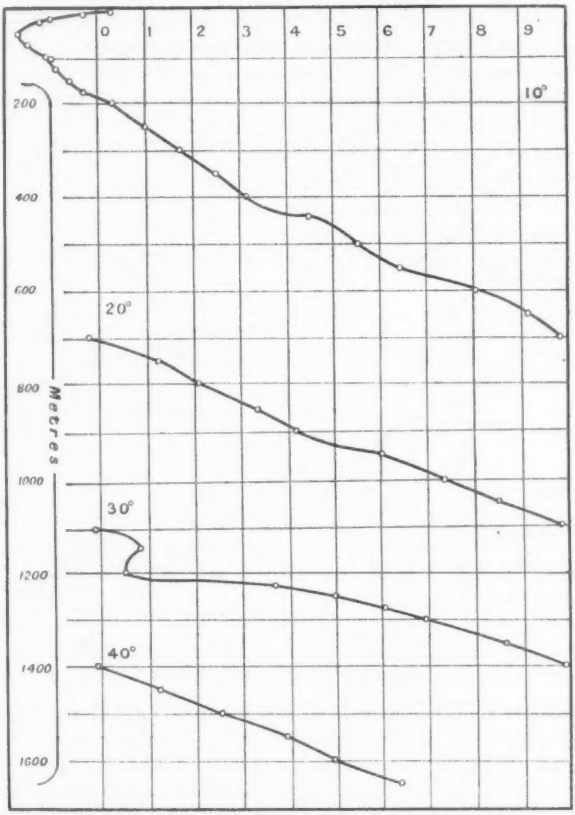


Diagram 2.—Temperature Diagram of Well Sieghart I. The dots indicate observed data. Above 200 m. temperatures are below 10°. At 200, 700, 1100, and 1400 m. respectively, curve has been shifted 10° to left.

above that point, we have a regular inversion. It is difficult to decide to what extent this inversion affects the temperatures observed higher up, but if there is any effect it must be very slight. The diagram shows another inversion above the depth of 50 metres due to the fact that the observations were taken in September, at the time when the summer heat reaches the deepest into the ground.

This part of the curve does not need to be taken into consideration. We notice also slight inflections at 400, 550, 730, and 920 metres. The four fragments of the curve, drawn on the diagram, do not run parallel to each other; their distances change, which means that the gradient does not remain the same from the top to the bottom. In other wells such bendings are also frequently the connecting links between practically straight lines of different gradient.

In most wells certain changes of gradient according to depth form the rule.

Faults, differences of rock, from one group of strata to another, and abrupt changes of the dip, are probably the principal causes of the observed variations of gradient. The conduction of heat across the strata is less than in the direction of the beds.

Therefore, by taking into consideration only the records of such wells as Sieghart I., we are able to make comparisons and deduct conclusions concerning the thermal conditions of this very small block of the Earth's crust thus dealt with. Such a detailed study is most instructive and beneficial, mainly because it may serve as a warning against far-reaching speculations based upon comparisons of data obtained in isolated borings in different regions very distant from each other. To my mind, any one who is enthusiastically inclined after reading Daly's most instructive discussion of geothermic data (*Amer. Jour. of Sci.*, May 1923, p. 349), should go back for a while to the very reserved statements of Prestwich * before reaching a conclusion on what may be deducted from known facts.

A geological section in the area has recently been described by Joachim Hempel ('Komos,' Lwów, 1925). This section is indicated by the letters J, H on the first diagram. Other sections established by Konstanty Tołwinski (*Stacja geol.*, Biuletyn 8. Borysław, 1925) run along the lines K, T.

The line FF, on the same diagram, indicates the northern front of the oil-bearing strata of the recumbent anticline of Borysław, and the line SS marks the outcrops of the fault plane of the overthrust along its northern limit. A number of faults dissect the oil-bearing strata into separate blocks, with considerable downthrow in some cases.

It seems probable that the thermic relations may differ in adjoining blocks. If so, it becomes comprehensible why in two wells situated in close proximity, on either side of a fault, we sometimes notice a much greater difference in the temperature curves than between wells farther apart, belonging to the same block.

Although the number of wells studied up to the present time is insufficient for a detailed study of the geothermic conditions of the limited area taken into consideration, most interesting deductions may already be drawn, and several remarkable correlations appear between gradients and tectonics. The remaining diagrams (Nos. 3, 4, 5) represent: first, the isotherms at sea-level (the altitudes of the wells vary between

* 'Collected Papers on some Controverted Questions of Geology.' London, 1895.

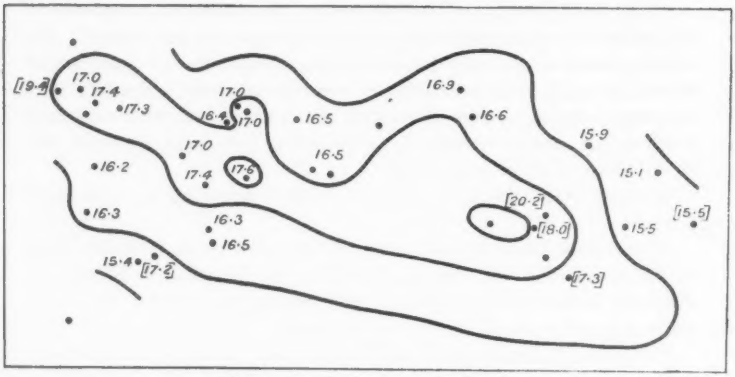


Diagram 3.—Isotherms at Sea-Level.

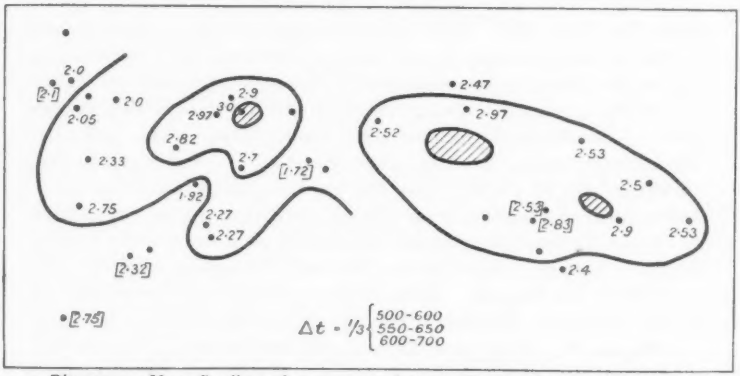


Diagram 4.—Mean Gradients for 100 metres between Depths of 500 and 700 metres.

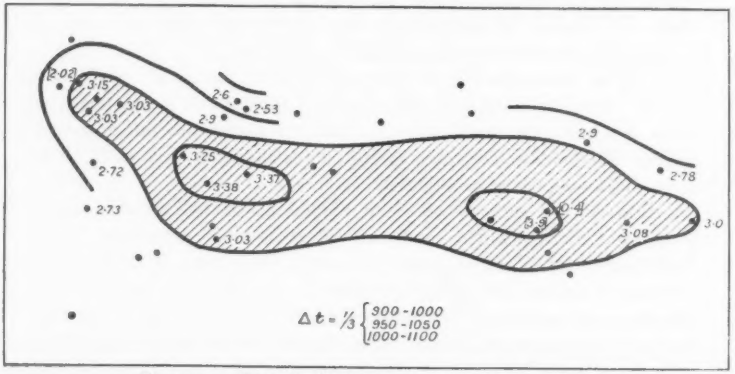


Diagram 5.—Mean Gradients between 900 and 1100 metres.

390 and 541 metres); second, the mean gradients at depths of 500 to 700 (one-third of the differences 500–600, 550–650, 600–700); and third, the same at depths of 900 to 1100 (calculated in the same way).

Further researches will certainly modify these drawings, but the data of to-day are sufficient to establish the close connection which exists between the geology of the region and its thermic relations.

The third diagram reveals the existence of an elongated area in which temperatures are higher than to the north, south, east, or west. This area corresponds with the uplift of the fold of Borysław, which towers up in the middle part and gradually plunges down on both sides (north-west and south-east) as Kropaczek has clearly demonstrated in his monograph, published in 1919.

Towards the north-east we have the front of the fold, and it is where the strata of this anticline are the most inclined that temperatures should be highest. In the south-west we have the overthrust, and beneath a smaller dip of the oil beds.

A comparison of the fourth and fifth diagrams gives us some idea of what we may expect below the depths which are geologically known.

The rocks beneath the fold have been reached in a few borings only, and we do not know if the fold grades into a fault-plane. But the temperature data suggest a tortional movement, due perhaps to a lag on both sides with a greater squeezing of the fold. Further researches will probably give the necessary data to discuss this question.

Among the results reached so far, I should like to draw attention to the fact that the geothermic degree found for different portions of the same well may vary between 71·5 metres, and 23·5 metres (well Jan Kanty IX. (No. 32), between 250 and 350 metres and between 1000 and 1100 metres), and that in various wells we observe also for the same differences of level very different geothermic degrees.

Between 1000 and 1100 metres we have already noted an increase of 1° for 23·5 metres in the well Jan Kanty IX., while at the same depth in the well Horodyszcze III. (No. 31) the figure is 39·2 metres.

In both cases we have wells practically devoid of any escape of gas.

APPARENT MAGNITUDE IN NATURAL SCENERY, AND ITS DETERMINING CAUSES

Vaughan Cornish, D.Sc.

Read at the Southampton Meeting of the British Association, 1925, in Section E (Geography).

THE Effect of Gradation of Tone.—About a month ago, when I was staying at the Kleine Scheidegg, the Jungfrau stood out with every detail not only clear but harsh in the strong sunlight. A

rainstorm came up from the Lauterbrunnen valley, and the mountains then loomed very large. The details of rock and glacier were visible through the screen of rain-drops, but greatly softened in tone, whereas the tone of the grassy foreground was not changed in anything like the same degree. The increased recession, to which the increase of apparent height is doubtless due, was therefore caused by the greater toning down of the distant as compared with the nearer part, by an increase of atmospheric perspective, not by obliteration of detail. From Wengen I watched the Jungfrau by daylight, morning and evening twilight, starlight and moonlight, and noticed that the size of the mountain was less impressive at night when hardly any detail was visible either in the distant or nearer parts of the landscape. Similarly I have noticed on the plateau country at Camberley that the skyline of a pine plantation about half a mile distant does not recede when the landscape darkens as a whole at night.

The Effect of Banded Colours.—From a position in Great Malvern, about 400 feet above the valley of the Severn, the more distant parts of the nearly flat plain were visible, and also the barrier of level-topped hills which bounds the valley on the east. When I descended to the plain itself I found that there were points on the lower level where the eastward view gave a far greater impression of distance. The same hills bounded the horizon, and they were actually rather nearer, but they were strongly suffused with atmospheric blue and looked far, far away. This effect occurred when they were seen just above a slight ridge near enough at hand to show strong local colour in the bright May sun. It is well known that when contrasting colours are placed side by side each has its tint enhanced. Thus by the cutting out of some of the undulations of the plain, and by the perspective contraction of the few which remain visible to narrow and nearly horizontal bands, the contrast of colour between the foreground and horizon is forced, and the apparent distance of the latter enhanced by this exaggeration of colour perspective. Of all recessional effects in landscape none has a more general appeal to the æsthetic sense than the "blue distance" which is so characteristic of brilliantly clear weather in those parts of the English Lowlands, the Fen Country in particular, where hills rise from beyond the general horizon.

The Effect of Opening-out and Unfolding.—It is common knowledge that the distant parts of the landscape seem to occupy a larger angle than those in the foreground which actually have the same angle, but when I first tried an experiment I was surprised at the amount of the exaggeration. I was walking on the open pasture of the Riffelalp not far above the timber-line in the brilliant sunshine of early June. The pasture, lately freed from snow, was dotted with exquisite flowers. Across the deep and narrow valley the Matterhorn rose white and huge, the peak, some 4000 feet from saddle to summit, dominating all others in the view. I laid myself upon the ground in order to look more closely

at the bell gentians and anemones, mentally contrasting the minuteness of their beauty with the grandeur of the great peak. A pair of gentians grew side by side just within reach. It occurred to me to try how the space which one of these little flowers occupied in the view compared with the height of the Matterhorn. Stretching out my hand I was just able to reach the flowers, one of which I plucked and held up at the same distance, that is to say at full arm's length, in front of the mountain. The flower, 2 inches in height, just covered the mountain peak from saddle to summit. Surprised at the result, I looked at the companion flower which I had left unpicked, but, even now that I had learnt that its height was geometrically equal to that of the peak, it only seemed to have *about* one-quarter of this size. As the view of the Matterhorn from this spot is famous, it may excite surprise that the peak proper, the most remarkable in all the Alps, should occupy so small a space in the view. The angle however, some 4 or 5 degrees, is sufficient to span the "yellow spot" of the retina, which is the only part capable of appreciating precise form. As this mountain peak largely depends for its character upon details of form, it may well be that the angle which it occupies as seen from just above the timber-line on the Riffelalp is about the right space for the principal object in what I will term the Field of Attention.

The following example illustrates the effect of increased spaciousness which results from the increased proportion of the distant parts of the view when observed from a height. The scene is on the Riviera near the frontier of France and Italy. Here from the Tête du Chien above Monaco to Grimaldi on the east of Mentone a 7-mile front of sea is backed by an amphitheatre of mountains which rises 4500 feet at a horizontal distance of only 4 miles from the shore. Leaving Mentone at nine o'clock on a brilliant winter morning, I went by way of the Old Town to the crest of the sandstone spur along which the mule-track runs to Castellar. Passing through the narrow streets of the perched-up village and out on to the bare slopes above, and leaving the ruins of Old Castellar on the right, I climbed the rough ascent of the Berceau Peak, reaching the summit a little after midday. Throughout the morning as I climbed the horizon of the sea went on climbing into the sky. From the summit of the mountains this line was definite, clear and strong, although more than 70 miles away. The expanse of the calm sea from the shore of the Bay of Mentone to the far-off horizon was so magnificent in its vastness that the lapse of more than forty years has scarcely dimmed the splendour of the impression. Yet the vertical angle occupied by this expanse of water is the same as that of the comparatively narrow-looking strip of sea visible from a position on the beach about 20 feet from the waves. The proportion of the distant to the nearer parts is however much greater, and this is a main cause in the magnification.

The heightening of a mountain when we ascend to a great elevation

on the other side of the valley, and also the increased spaciousness of undulating country as seen from a height, owes much also to unfolding of the stepped or rolling formations, an effect so entirely rational that it calls for no laboured explanation.

The Effect of a Descending Foreground to increase the Apparent Height of a Mountain.—There is, however, another process by which the ascent of an opposite slope increases the apparent height of a mountain, namely, the drawing down of the eye by a steeply descending foreground. No muscular sensation warns the observer that his gaze has departed, by many degrees, from level outlook, and the fact that the summit of the mountain is near the top of the picture gives the same impression as if it approached the zenith. This important effect is produced by a slope of quite insignificant height, provided that it be steep.

The Effect of the Skyline to make an Eminence appear greater when viewed as a Declivity.—Whether the dynamic associations connected with the force of gravity have something to do with this or not, the reversed effect of the skyline is undoubtedly a cause, and may be by itself a sufficient cause. When looking up, the eye is attracted by the crest-line of the mountain, so that the intermediate point is kept down in the picture and therefore towers less. When we look out from the intermediate position, the eye does not rest easily on the foot of the slope, being strongly attracted by the skyline. The foot of the mountain is thus thrust further down towards the bottom of the picture, and the look of Depth is consequently increased.

The Effect upon the Natural Picture of an Indefinite Margin.—The great height of the cirrus cloud overhead becomes apparent when lower cloud of more substantial texture acts as a foreground, but the best *repoussoir* is formed by a gap in whirling mountain mist irradiated by the sun, for then no defined edge distracts the eye from the delicate structure calmly floating in the upper air to which the strong difference of tone gives so great a height and distance. In this case the object which occupies our attention may be compared to a drawing provided with a broad mount.

The impression of Depth from a culminating eminence depends jointly upon the linear elevation and the absence of the substantial foreground which an ample platform provides. When the drop is nearly sheer, and *sufficiently deep for the space below to be strongly suffused with atmospheric tone and tint*, the distant view seems no longer to be solidly bound to the rest of the world, but to float in æther, as if it were a landscape let down with cords from heaven. Thus it is probably to the broad margin below, of which we are but half conscious, that the picture which occupies our attention from a lofty summit owes much of its transcendental effect upon the mind.*

* I offer this explanation with the diffidence proper to one who has not climbed above 11,000 feet, and has not ascended peaks of more than 7000. But even from

The Effect of Downland to increase the Sense of Space.—The eye is very sensitive to any disposition of landscape features which seems to restrict the fullness of outlook. Thus if, when travelling by train through the Chalk Downs, a broad, smooth swelling of the ground near at hand suddenly shuts out the distant view, restricting the landscape proper to a single cultivated field with smooth skyline, this seems quite inadequate for the lower half of a full outlook, and the eye unconsciously lifts so much that far more of the sky is embraced. The extreme simplicity of the view, moreover, extends the lateral ranging of the eye, the attention not being tied, and, on both counts, a sense of spaciousness fills the mind at the very moment when the horizon comes near.

Let us suppose that, to begin with, the skyline is in the middle of the Field of Attention, and that this field has a vertical diameter of about 60°, which I find to be a common value, the vertical ranging of the eye comprising therefore 30° of sky and 30° of the landscape proper. If we then change our station to a point where a slight rise in the ground close at hand restricts the landscape to 100 yards or so, this does not seem to provide the half of an open outlook on the world, and our glance, as I have said, spontaneously takes an upward tilt. Suppose that this tilt be 15° (which would not be attended by any warning muscular sensation), then we have added nearly 50 per cent. to the geometrical height of our sky view and only cut off about 12 feet from the foreground of the landscape.

The Effect of Certain Patterns to spread the Field of Attention.—Broad masses of cumulus cloud spread the Field of Attention, and it might therefore be anticipated that the tiny leaves of Spring would narrow it down in the forest, but they do not; for, whilst they attract, they are not able to hold the eye, which consequently roams among them in all directions. The constellations also form a spot-pattern which spreads the Field of Attention, the effect being, moreover, enhanced by the twinkling of the stars which draws the eye this way or that.

A cloudless sky by day, when of almost uniform blue, does not always show shape, and in this case the sense of expansive surface is imperfectly conveyed. Occasionally, however, there is a gradation of tone and tint in cloudless sky which gives distinctly the effect of a concave roof of bold camber, and when the view-point is lofty and commands an extensive plain which provides a vast floor from which the vault seems to rise, the latter forms one of the finest expanses in the world.

The Effect of a Change in the Angle of the Field of Attention upon the Apparent Magnitude of an Object in the Field.—Many seemingly capricious variations of apparent magnitude in scenery are caused by the unconscious variation of the Field of Attention. Of all habits of the

sea-cliffs of 500 feet in height the ætherialization of that which lies below the field of attention become noticeable when one stands on the very edge.

eye which affect spontaneous impressions of scenic magnitude none eludes recognition more cunningly than this.

The first observation which I have to recount was made within doors. I was occupying a bedroom of long and narrow shape lighted by a window at one end, the bed being at the other end. When the blind was drawn in the morning I looked out from my bed upon an unattractive house which bulked unpleasantly large. I noticed, however, when standing at the dressing-table in the window, that the house seemed to take up much less space. Returning to the far end of the room, I fixed my gaze upon the house and, keeping it so fixed, walked towards the window. As I approached the window, the house opposite seemed to shrink into itself until it looked only about one-half the size which it had appeared from the far end of the room. I found on further examination that whereas when seen from the far end of the room the opposite house spanned the width of the window, when viewed standing at the dressing-table in front of the window it occupied less than half the aperture. In this experiment the angle which really varied was, of course, that occupied by the window; that which seemed to vary was that of the object received through the window. It would be natural to suppose that nothing of this kind would happen out of doors, since the aperture of the window from which we *can* look out on the landscape, that is to say the angular aperture of the eye, does not vary. Numerous observations, however, have shown me that we assume that the aperture which we actually use varies comparatively little, whereas in fact it varies greatly. On the day already referred to when I compared the apparent size of a bell gentian with that of the peak of the Matterhorn, I noticed that this peak appeared much larger as soon as I left the open pasture and entered the sparse wood of rugged fir trees just below. I had sketched the outline of the peak from the open situation; I now made another pencil outline of the peak from my new position, drawing rapidly so as to concentrate perception and cut out thought. The size of the peak was exactly twice as great in the sketch made from among the trees. As the shape of the peak was exactly the same in the two sketches this difference cannot be attributed to bad drawing, and is best explained on the supposition that among the trees the Field of Attention was much smaller than in the open, and that, this reduction being unnoticed, the effect was to magnify the principal object within the field.

Panoramic Extent, or Frontage, as a Scenic Magnitude.—When a mountainous land is viewed from the sea, or across a broad lake, the strong, straight, level brow of the water surface has the effect of bringing the mountains into line with itself, and the raised skyline, undulating or serrated, crowns an imposing water-front, the natural equivalent of such features as the river front of Somerset House and the Houses of Parliament.

Usually, however, frontage is a kind of magnitude which has not so

strong an appeal in Natural Scenery as Height or Recessional Distance. I had a good illustration of this one day in December, when the Swiss mountains were swathed in snow and the fir trees silvered with frost. I was looking from Caux across the deep and narrow Verraye Gorge at the long forested ridge which, rising from the Lake of Geneva behind the Castle of Chillon, culminates in the Rochers de Naye. Presently puffs of chilly wind came up from the lake, followed almost immediately by an ascending mist, which whirled up the gorge in large detached masses. The end of the ridge near the lake and the end near the Rochers de Naye were blotted out, only the middle part, opposite me, remaining visible and clear, not seen through mist but in a gap between the mists. This part of the steep forested ridge, with its tier upon tier of silver spires, instantly took on a look of gigantic height. The reduction in the frontage of the panorama was not attended by any sense of æsthetic deprivation; what was felt, and felt with a thrill, was an immense addition to height.

Volume and Mass as Scenic Magnitudes.—The outstanding surface of a mountain block gives a more direct impression of cubic content, or volume, than the reflecting surface of the sea or the transparent depths of the atmosphere; but it is Mass more than Volume which impresses the imagination when the atmospheric veil of the great mountains is removed on a near approach, revealing the character of their substance. Mass, although not a geometrical, is a physical magnitude of considerable importance in scenic effect. At Grindelwald when the sun shines full upon the Wetterhorn the mountain often has the appearance of a crushing load, and many people find the effect repellant. In such situations the beauty of the scene greatly depends upon soft tone, particularly that given by illumination from above and behind the mountain, which prevents the quality of ponderous mass from dominating the qualities of height and form.

Cyclopæan Structure, or Giantism, in Scenery.—It is often remarked that the size of a mountain is less impressive close at hand than from a distance. There is, however, one kind of geometrical magnitude in mountain scencery which is only felt upon near approach, that of cyclopæan size of the parts; an effect often dependent upon the scale of bedding and jointing. The crevasses and *seracs* of glaciers contribute to the effect, which is that of a structure moulded by giant hands. The cyclopæan character has always impressed the imagination of mankind, as is shown by the primitive tradition of many countries, which ascribes such features of Scenery to "the Giants."

THE SARGASSO SEA

Capt. C. C. Dixon

Map follows p. 480.

THE Sargasso weed, when present in the largest masses in which it is ever seen, looks like a wide moor flooded until the plants that grow upon it are submerged to within half an inch or so of their topmost sprays. Looking at the weed-covered areas from the deck of a liner, the open water between the patches, the shallowness of the layer of weed, and the open structure of patches and frailty of the plants themselves are easily seen. From the deck of a small sailing vessel such as first traversed these seas quite a different opinion could be formed. From their low decks the detached patches, blended by perspective, assumed an appearance of considerable solidity. The vessels were manned by races of fertile and lively imagination; the traverses were made mostly across a region of light winds and where perfect calm frequently lasts many days. During these calm spells the weed often collects in quite large fields.

Moonless, windless, silent nights in this weed-strewn sea became nights of horror. Who could know whether this weed got thicker and thicker till there was no turning back? Its changing tints and shadows as daylight faded and at the approach of dawn needed but little help from the imagination to be wrought into fearsome monsters that inhabited its depth and whose very appearance would steal away one's sanity. Each would relate what he thought he saw or heard. In the frequent repetition of these tales they would gather from time to time fresh material until in the aggregate they would be looked upon as an actual experience that in subsequent voyages would be viewed in the light of a sworn statement of facts.

Four varieties of the weed itself are all I can bring to mind.

The first, and by far the most plentiful, is a small bushy plant with numerous short stems and branches all along them, so that floating it assumes a globular form. When young or growing it is a light greenish-yellow. The leaves are from 1 inch to 1½ inches in length, narrow and thin. The sprays are plentifully supplied with small vesicles or hollow globular floats about half the size of a pea.

The second variety has larger leaves from 1½ to 2 inches and about ¼ of an inch broad; they are also thicker. The floats are about the size of a pea. The stalks and branches are longer and not so many on one root. The stems, leaves, and floats are all covered with a fine brown hair about one-eighth of an inch long. On close inspection when afloat this hair gives the plant a very beautiful appearance; out of the water it is practically invisible to the naked eye.

The third variety is similar to the second except that it is without the hair, the leaves narrower, and the floats smaller and harder.

The fourth variety is seldom seen and probably does not, strictly speaking, belong to this region. It is distinctly greenish, with thick slimy flat stems and oval-shaped floats. It is never seen in bunches or patches, but just an odd piece or two in with the other weed. It is apparently a rock weed like our bladder-wrack.

The distribution of the weed and the boundaries within which it is found are shown on the folding map.

From the time I first set down notes concerning the weed, the amount seen was described by various adjectives without any thought of eventually formulating a scale. On going through the records to reduce the observations to a numerical scale my lack of vocabulary was a great asset, for the number of adjectives and phrases used to describe the amount of weed present was very limited.

THE SCALE.

1	represents	the	phrase	"An odd piece or two at long intervals."
2	,,	,,	,,	"very little weed."
3	,,	,,	,,	"little" or "some weed."
4	,,	,,	,,	"moderate amount" or "fair amount."
5	,,	,,	,,	"considerable amount."
6	,,	,,	,,	"much weed," "quite a lot," "quite thick," "quite a large amount."
7	,,	,,	,,	"large quantities."
8	,,	,,	,,	"great quantities."
9	,,	,,	,,	"immense quantities."

10 I reserved for any account of the whole surface being covered in the vicinity of the vessel. But this number I never had any occasion to use.

Experiments to determine the amount of weed in tons per square nautical mile were carried out on three occasions. The results of two of them were sent to the *Journal* and published in a short note (*Geo. Journ.* 59, 476; 60, 317). The data for the third were not then available. In a way it is the most useful, as it was carried out in a region where the Sargasso Sea appears on most charts.

The first experiment (not included in the note in the *Journal*) was made on 18 June 1918 in lat. 29° 4′ N. and long. 71° 0′ W., while on passage from Paagumene, New Caledonia, to New York. The amount of weed present at the time of the experiment corresponded to 6 on the scale adopted.

A net with a mouth 2 feet in diameter was towed from an out-rigger some 15 feet long to keep it well clear of the weed that was directly in the ship's course and passed close alongside. The speed of the vessel at the time of the experiment was 1½ knots (there being just an appreciable air of wind). The net was towed one hour and twenty minutes, which makes two nautical miles. The length of the line by which it was towed was regulated so that the increasing resistance as it collected weed never

raised the mouth above water more than half its diameter; the widest part, 2 feet, would be always at the surface. As the net was of good depth, about 4 feet, it was not necessary to pull it in to empty it until the end of the appointed time.

In the 2 miles 16 lbs. of weed were caught. This figures out at 10·9 tons (of 2240 lbs.) to the square nautical mile.

The next experiment was made on the following voyage, on 21 September 1919 while on passage from Sydney, N.S.W., to Liverpool. On this occasion a net 20 inches in diameter was towed through 6 miles, the weed density at the time being also 6 by scale as before. The speed of the ship this time being 4 knots, the net had to be emptied several times or it would tow right on top of the water. The time so lost was estimated at 7 per cent. The amount of weed collected was 35 lbs. This works out at 10·2 tons per square nautical mile.

On the day following, when by estimation there was weed around corresponding to 8 on the scale, a similar experiment gave 18 tons to the square mile. I have not the original notes on this experiment.

From these figures I deduce the following rough equivalents:

Scale 3 corresponds to 5·3 tons per square nautical mile.
" 4 " " 7·0 " " "
" 5 " " 8·8 " " "
" 6 " " 10·5 " " "

The following is an estimate of the total area of region over which the weed is found, using the approximate boundaries found by my own observations, but including one district which I did not cross in any of my voyages. (As this is the place always set down as forming part of the Sargasso Sea it may be safely included in the estimate.)

District "A," between the 20th and 30th parallels of north lat.
" " " " 40th and 75th meridians of west long.
" "B," " " 30th and 40th parallels.
" " " 35th and 50th meridians.
" "C," " " 30th and 40th parallels.
" " " 50th and 70th meridians.

From the areas of these districts and a fair estimate from the chart of the density of the weed in each district we can arrive at the approximate amount of weed that is afloat on the Atlantic.

This result may be of no particular use except that for which it is used here, to prove that the weed cannot all die and be replaced in one year, probably not inside four years.

District.	*Area in square N.M.*	*Estimated density by scale.*	*Corresponding amount in tons.*	*Total amount of weed in tons in each district.*
"A"	1,141,950	... 6	... 10·5	... 12,000,000
"B"	442,344	... 5	... 8·8	... 3,900,000
"C"	589,788	... 4	... 7·0	... 4,100,000
	2,663,490			20,000,000

If the supply comes from the banks in the Caribbean Sea it must practically all come through the Straits of Florida, and it remains to determine the amount that passes through the Straits per year. Some authorities give the mean velocity at 2·5 knots; some give it as high as 3 knots—the mean of the two being 2·75 knots. The straits are about 40 miles wide. The average density of the weed seen there is 3 on the scale, which equals 5·3 tons per square nautical mile.

$2{\cdot}75 \times 24 \times 40 \times 365 \times 5{\cdot}3$ gives 5,100,000 tons per year passing through the Straits. Four times this amount is 20,400,000 tons, only about 2 per cent. more than the approximate amount afloat on the Atlantic. Even if this conclusion is based on very slender evidence indeed, it is at least a somewhat remarkable coincidence.

On the problem of the source of the weed I have very little information. I have seen it growing on the shallower portions of the Yucatan and Mosquito Banks when sailing over them. It has been brought up on the hook when fishing in deeper portions. I do not know whether it grows on the Florida Banks. It does not seem to grow very closely, but it should weigh as much per acre as hay, that is about a ton. If it grows uniformly over the Yucatan and Mosquito Banks only, there is an enormous supply to draw on: the area of the Yucatan Bank is about 47,010 square nautical miles, the Mosquito about 19,500 square nautical miles. With the growing weed at a ton to the acre, it works out to approximately 56 million tons.

That this area is the source of supply of the Sargasso Sea is now usually accepted. The article on the Sargasso Weed in the *Encyclopædia Britannica* says: "When such plants break away they are enabled to float for great distances. The great Sargasso Sea of the North Atlantic is probably only renewed by the constant addition of plants detached from the shores of the Caribbean Sea and Gulf of Mexico."

Commander Soley writes of the weed and its disintegration: "It (the Sargasso Sea) is at its greatest extent about August; by the end of the year the amount has greatly diminished through the gradual disintegration of the weed" (*Geo. Journ.* 60, p. 318).

From his data Commander Soley would likely be able to define the boundaries of "Sea" in the various seasons of the year quite exactly; but if this decrease in area is observable, it is fairly certain it is not due to the amount of weed that has died and sunk in that season. It certainly does die and sink very much in the manner he describes, but not at any one season. The change in area may be due to the supply being intermittent or having definite maximum and minimum each year.

After severe hurricanes in the vicinity of the banks it is probable that great amounts of the weed break adrift and reach the western part of the Sargasso area some three months or so later. While the maximum of supply might correspond with the hurricane season, it could be completely masked by a violent storm at the beginning or end of the season

in that locality and all the others in northern or eastern parts of the Caribbean Sea where the banks would be unaffected. The accession of weed to the Sargasso Sea, therefore, is probably somewhat irregular, while its disintegration is probably continuous. For the dying weed is not more often met with at the northern limits of the area where, under the circumstances Commander Soley mentions, it might reasonably be expected—the colder water and cooling atmosphere of late autumn and early winter hastening the extinction of its life.

The two inset maps show the distribution in area and condition of the weed. On the map for September to October a passage from the St. Lawrence to the Panama Canal is shown: from 37° N. to 30° N. on the 65th meridian nothing was met with except fresh light yellow weed on September 16 and 17. The following day, in 29° N., only old dying weed was encountered—no trace of the fresh yellow weed. On another voyage shown on this diagram only old weed was seen on September 17 in 35° N., 47° W. Two days later, in 41° N. and approximately same longitude, only fresh weed was seen; similarly on September 24 in 43° N. and 40° W.—practically the limit of the weed at any season. Still later in the year, October 5, in 36° N. and 34° W., there was fresh weed only, while just a few days previously, September 27, 31° N. and 39° W., it was nearly all old and dying weed.

On the second inset, the sharp division between the areas of young fresh weed and old dying weed is well shown, particularly in a northward passage from Barbadoes to the St. Lawrence. It also shows fresh weed at the limits of the area in July, as previously found in October.

It looks as though the state of the weed were a question of locality rather than season or sea temperature. Paradoxically, most of the dead weed seems to be in the warmer water. If this is so, it may be due to the rapid formation of the coraline growths in the warmer water, after the weed has lost its vitality in the colder northern waters and has been swept back in the area north-west of the West Indies particularly favourable to the coraline growth. When the weed has thus lost buoyancy, should a wave in breaking carry it down even 30 feet, the increased pres sure may compress the weakened walls of the floats, lessen their displacement, and cause them to sink.

In conclusion, it seems evident that the weed must live longer than the period generally attributed to it. Even if it continues to grow as a free floating plant, I do not think that there are any new separate plants formed—the only way by which the amount of weed could be increased. The fresh weed consists of distinct separate plants, not broken pieces. Though the figures given above may require correction, it is fairly certain that the amount passing through the Straits of Florida is insufficient to replenish the whole area every year. If the weed lived to make two circuits of the Atlantic, it would make the period from three and a half to four years.

An impressive feature of the Sargasso region are its " rivers." When in a small boat the winding bands of water free from weed look exactly like a river. Through the low elevation of the eye, the breaks between the patches of weed at the sides are hardly noticeable, and at dusk they assume an appearance of solidity that makes the clear water appear a very real river, and it requires a distinct effort of the will to steer the boat into one of the banks even if you really know it consists of loose weed. But when you do you will be conscious of no change except that of passing from clear water to where the surface was weed-strewn, for it offers not the slightest resistance; in fact, it is doubtful if it ever really touches the boat, the slight bow wave of the slowly moving boat is sufficient to open a clear passage. The length and general direction of these slightly winding " rivers " appear quite fixed, and steering along one you might be under the impression that you were steering in some definite direction. But they are in truth phantom rivers. If your attention is diverted for a moment or two and you look around you find yourself steering into the bank and hurriedly alter your course thinking you have not been watching the steering; but if you have a compass or the day is not overcast you will find it is the river that has closed and opened out in a new direction.

I think the early explorers must have noted this when becalmed amongst the weed for days. To them it may have appeared as insidious movements wrought by the evil spirits of the place to make them lose their way and eventually wrap them and their frail caravels in winding-sheets of weed.

Some notes upon the life found in the weed are appended.

Of the larger and better known of the tropical and sub-tropical oceanic fish only the Dolphin (*Coryphæna hippurus*) and the Yellow Tail (*Seriola Lalandii*) were seen in regions where the weed was found. The Albacore (*Thunnus alalonga*) and the Bonito (*Thunnus pelamys*), several of their relations, and the Barracuda (*Sphyræna barracuda*) were found in regions east of the West Indies and Florida, where there seems at times to be some weed. The Dolphin was the only one actually seen swimming in and out amongst the bunches of weed looking for food.

Although often becalmed in these regions I have never seen a shark amongst the weed. Numbers have been seen and caught both north and south of the area, and also east and west of it, but that may probably be pure chance.

The smaller fish seen there are also met with elsewhere besides the Sargasso region.

The Wreck-fish, or Stone-bass (*Polyprion americanus*), seems to be particularly suited to this part of the ocean by his name and habits. It was found with practically every piece of flotsam, from a broken packing-case board to a floating lifebelt cork. It makes use of the

wreckage as a base of operation and returns to its shelter when danger threatens. The ones we caught at various times were from 6 to 7 inches in length.

The Pilot-fish (*Naucrates ductor*) is fairly common, the smaller ones being seen in company with turtles, the larger mostly swimming about alone. They take the hook readily, but go quite insane when hooked, and are difficult to land in spite of their size, 6 to 16 inches.

File Fish (*Balistes vetula*) are met with quite often and mostly in the immediate vicinity of small bits of wreckage. Flying Fish (*Exocoetus spilopterus*) are also seen swimming about in small shoals, but often quite alone. They also will take a hook, a fact which it seems is not generally known. They cannot swim more than 10 miles per hour.

One fish peculiar to the weed itself is a diminutive flying fish, some 2 to 3 inches long, brownish-yellow with variegated markings that render it quite invisible when at rest amongst the weed. This creature is perhaps more like the Sea Moth (*Pegasus volitans*) of Eastern seas than a true flying fish. I never saw one at close quarters, less than 15 or 20 feet. There is also the Marbled Angler (*Antennarius marmoratus*), a grotesque fish 1 to 4 inches long, very thick for its length, and covered with growths that are subdivided at their extremities like thin flexible fingers. The extremities of its fins and tail are the shape of the fronds of maidenhair ferns. It is brownish-yellow in colour, marbled, as its name implies, with darker and lighter shades of the same colour. Finally there is the Ocean Pipe-fish (*Nerophis æquoreus*), a close relation of the Sea-horse. It is a very thin slim fish of a yellowish-green colour from 4 to 7 inches (it grows, I believe, to about 16). Mr. J. T. Nichols of the American Museum of Natural History, New York, states that they are found on only one side of the Atlantic.

With the exception of two extremely rare abyssal fish that were picked up in a weed-strewn area and two other large fish, in size between a Basking and the great Whale Shark, the list above includes every fish I have seen in the Sargasso region.

The following notes on the smaller forms of life that live in the weed and use it as a raft to be carried from place to place are set down as the observations of an untrained observer.

The Crabs are the most abundant form of life in the weed, and three small species and one large one are found. The small ones are from about $\frac{1}{8}$ of an inch to $\frac{3}{4}$ of an inch in breadth, and they are but little broader than they are long. One is a yellowish-brown with small dots of white or a light yellow, another yellowish-brown with a large white spot covering the greater portion of the back, the other of the same general colouring but with a large purple spot on the back. Then there is the large ever-present one, yellowish-brown with some fine white markings. In size it is from about 1 inch to 4 inches in breadth, and the shell at the two sides tapers off into a long spine.

Three species of Shrimps or Prawns are found: a yellow one about 2 or 2½ inches in length, and two very tiny ones about ¾ of an inch long. One of these is bright red and the other a deep purple, both with tiny white dots all over them.

Of the snail-like creatures, or *Gastropods*, it is said there are some ten thousand species, mostly marine, but that very few indeed come from the deep sea. Of these few I have seen two: one that inhabits a shell not unlike that of the common snail, but thin and frail, and of a pale but beautiful violet colour, and so light that the least bit of imprisoned air will keep it afloat. The Sub-Order *Heteropoda*, Family *Atlantidæ*, Genus *Atlanta* seems to include this creature. The other one is perhaps the most grotesque creature of its kind found in the world. There seems to be a division of opinion as to what it should be named. One authority calls it *Dentronotus arborescens*; another classifies it as Genus *Scyllæa*, sp. *Scyllus pelagica*. The creature is only some 2 inches in length. It has wings on its back extending the whole length of the body, with strange variations in shape and a number of excrescences with fan-like extremities in most unexpected positions, the whole resembling a tough semi-translucent jelly, yellowish-brown in colour. Two species of Turtles complete the list of all the living creatures I have at any time seen in the Sargasso Sea.

Darwin was right, I think, when, on the voyage in the *Beagle*, he said, "There was more variety of life in and about one leaf of Kelp growing about the shores of Tierra del Fuego than in the whole Sargasso Sea." The only thing is that the life in the Sargasso region makes up in grotesqueness what it lacks in variety and amount.

The following summary is offered as a suggestion of probabilities towards which the facts available seem to point. There are however three exceptions; statements Nos. 1 and 3 are made with a considerable amount of confidence that they will stand the light of more detailed investigation.

1. The weed is never anywhere sufficiently dense to prevent or impede to any appreciable extent the passage of any vessel, not even a rowing boat.

2. The life of the individual plants must be longer than is generally conceded. Certainly more than one year, probably more than four. The average amount passing out of the Caribbean Sea and Gulf of Mexico is approximately sufficient to replace all the weed afloat in the Atlantic in about four years. It is subject to considerable variation, dependent on the prevalence of hurricanes in the Caribbean Sea, their severity and proximity to the banks where the weed grows.

3. The death of the weed seems to be a question of locality, more of the dying weed being found in the warmer waters of the Atlantic rather than the colder. Its disintegration is a continuous process or is not seasonal.

4. Part of the seasonal change in area of the Sargasso Sea as noted by Commander Soley is probably due to the movement and shape of the area of high barometric pressure in the Atlantic which governs the seasonal sway of the trade winds, affects the contour of the southern margin of the Gulf Stream, and so the general circulation of the whole ocean.

5. The popular idea that the Sargasso Sea teems with life of great variety is an illusion. Both amount and variety are very limited.

6. The Sargasso Sea is slowly changing its position or is decreasing in area. Eighty years ago (according to certain directories of the Atlantic) weed was met with seven degrees north of the equator and in 15° W. long. Now it is never seen within 600 miles of those positions.

MOTOR TRACTORS FOR ANTARCTIC EXPLORATION

IN March last Lieut.-Commander Bernacchi undertook some trials of a Standpoint tractor at Finse, Norway, to test its suitability for use in the Antarctic. He has kindly communicated to us a report on the performance of the tractor by Engineer Rear-Admiral Skelton, one of Scott's officers on the *Discovery*, from which the following extracts are taken.

Report by Engineer Rear-Admiral Skelton.

The tractor was not specially fitted up for work in snow and cold climates in any way. The snow at Finse at the time was soft, considerably softer than average Antarctic snow in the Ross Barrier area. The foot of a man would sink at each step 8 to 12 inches on the average; there were places where one sank to the knee, while there were occasional patches with a crust in which one sank only to the ankle. The temperatures at Finse varied from −2° to −12° C. (29°·4–10°·4 F.), with strong breezes. Force 5 to 6 and heavy low drift; unpleasant blizzard weather.

The tractor arrived on an open railway truck at Finse on March 17. It was driven off the truck down railway sleepers on to the platform, under its own power, very soon after arrival. Starting up the engine, which had been out in the cold all night and without warming up, presented no difficulty. The radiator was then filled with a mixture of wood alcohol and water, about 1 to 6, to prevent freezing, gears and engine were oiled, and the petrol tank filled. In the afternoon the tractor was driven down to the lake and manœuvred about for the cinema operator; possibly a mile or two were covered. The radiator was emptied for the night for safety, although the mixture showed no signs of freezing.

On March 18 the tractor was driven across the lake, and on to the

slopes in the direction of the Hardanger Glacier; probably the total distance was 3 or 4 miles.

On March 19 the tractor was run across the lake in the forenoon and back again. In the afternoon two rough local sledges were towed with ten people on them, and a spring balance fitted to the tow rope; short runs were made on the lake, and approximately 5 to 6 miles were covered during the day.

On March 20, in very bad weather, with a temperature of --8° to —10° C., wind force 5 to 6, and thick low drift, the tractor was driven with the two sledges in tow, with four people on them, across the lake and up slopes towards the Hardanger Glacier and back again. In one place, on a steep slope of about 1 in 5 or 6, the tractor got into soft snow, sank well above the rear axle, churned snow without advancing, but came out going astern and mounted the slope which it could not deal with going ahead. About 4 or 5 miles were done at a speed of roughly 4 miles per hour, and the tractor then returned to the railway station, and was driven under its own power straight on to the railway truck for transport to Oslo.

Exact records of all details and performances were not taken; the conditions did not justify this, nor has the design or general arrangements arrived at a state to make it worth while. The quality of the petrol was not known, and the tests were made simply with the idea of finding out where improvements in design could be made.

No proper test of the draw-bar pull of the tractor on snow could be made, as sledges and loads were not available, but on Thursday, March 19, two sledges of very bad form were loaded with ten people and were towed with ease at 4 miles per hour on soft snow. The greatest pull shown on the spring balance was, at starting, just over 700 lbs., but the sustained pull while in motion was never much more than 300 lbs. This could have been much exceeded, but it is impossible to say by how much. The draw-bar pull on ordinary ground is of course well known. Taking an average of the Antarctic conditions which I saw during two and a quarter years, and while sledging for over one hundred and seventy days in various directions from McMurdo Sound, all man-pulling, I consider this tractor would draw loads down there suitably loaded on sledges to a surface pressure of about 1 lb. per square inch of runner surface, of 2 to 3 tons. This is a conservative estimate and with improvements should be increased. I do not however wish to be tied to these figures; it is really too early in the day to make estimates either optimistic or otherwise.

The lubricating oil was a special Arctic mobile oil used in Northern Canada, and was very successful.

The main improvements which can be made to fit this machine for snow traction are:

(*a*) A reduction of the weight per square inch of bearing surface, that is: (1) the weight of the machine must be decreased; (2) the bearing

surface must be increased. Both (1) and (2) can be altered to produce the desired result.

(*b*) The centre of weight should be further forward.

It was very interesting to see how well the tractor would climb slopes in reverse which it could not climb going ahead, although the reverse gear is not, as is often the case, in its favour. In cases where the tractor could not deal with very soft snow on a steep slope, and only proceeded to embed its driving wheels and to slip the tracks round, it would always come out astern immediately, and then proceed up the slope over the same ground going astern. In the Scott sledges we had no astern gear on the argument that the increase of weight was not justified, but, having seen what this new tractor can do astern, and the time that could be saved in difficult places by having astern gear, I have no hesitation in recommending its retention.

The tractor is generally a great improvement on the Scott tractors, the trial of which I attended in 1907, 1909 and 1910 in France and Norway; the engine, the transmission gear, and the general construction are much more robust, and generally provide a good basic article round which to build up an Antarctic snow tractor. The experiments were most convincing as to the value of this form of traction for Antarctic exploration. It will be recollected that the late Capt. Scott said of his tractors, and after the bitter disappointment of their breakdown, "one thing is proved: the system of propulsion is altogether satisfactory. Evidently the engines are not fitted for working in this climate—a fact that should be certainly capable of correction."

Although I have given the opinion that this tractor will serve or can be adapted for use in the Antarctic, it must be admitted that if a special tractor were to be designed purely for special Antarctic work, it would not conform in all details to the Stanpoint tractor. The Stanpoint tractor can however be readily modified and adapted at a moderate cost of time and money, while the special tractor would have to start right away from the drawing-office stage, and would take some time, and a proportionately high cost. In order to reduce weight every item of the tractor should be carefully considered in detail.

Although not part of the tractor itself, I consider it most important that a tent or weather covering for use when camped should be designed, capable of being quickly and easily rigged or struck. Without such a protection against the rigours of the climate, starting up, the retaining of engine heat after camping, small repairs, oiling, etc., would all be extremely difficult. The question of ability to man-handle all parts of the machine is one of the most important. Padded covers and wraps of non-conducting material should also be made to wrap round the engine on camping, so that all the heat possible may be retained until starting up again.

In a general consideration of the most suitable tractor for Antarctic

work, the personal factor is of immense importance. Larger and more powerful tractors drawing heavy loads are not suitable, and it is much better to divide the " caravan " into small units, say one tractor drawing four or five sledges loaded to a total of 4000 to 6000 lbs., each detail of which can be man-handled by the staff, which always has to be small for successful Antarctic journeys. The design and loading of the sledges to be towed are therefore also matters of great importance.

THE INTERNATIONAL MAP

Major M. N. Macleod, D.S.O., R.E., Secretary of the Central Bureau

Read at the British Association, Southampton, 1925, Section E (Geography).

THE Carte Internationale du Monde au Millionième, first suggested in 1891 by Prof. Penck, came into existence in 1909 at a conference held in London at the invitation of the British Government and attended by delegates of eleven nations. This conference laid down the scale, projection, and general style of the map, which was to be produced by international co-operation. Each nation interested was responsible for preparing and publishing the maps of its own dominions. Following the resolutions of this conference the first sheets made their appearance about two years later.

In 1913 a second conference was held in Paris at the invitation of the French Government, and was attended by delegates of thirty-four nations. This conference reviewed the London resolutions in the light of experience and amended or extended them. It also discussed and approved the establishment of a Central Bureau in Great Britain charged with the duty of co-ordinating the work of the various nations participating, and of recording the progress made in an Annual Report for the information of all interested.

Before the impetus given by this conference had time to take effect, and before the Central Bureau had been able to get into its stride, the Great War broke out, putting a stop for the time being to practically all the work in hand or projected, and interrupting in some cases the postal and other communications essential for international co-operation.

Enough had been done, however, to indicate both the value of an international map and suitable and convenient methods of preparation. Foreseeing that such a map would be of special value both during and after the war, the Royal Geographical Society undertook the preparation of a provisional series of sheets based on the international resolutions. These maps, compiled by the R.G.S., were published by the General Staff. The work, intended originally, I believe, as a sort of supplement to the International Map, as it then existed, was pushed on with such

energy and success that the sheets published form a continuous series covering all Europe and a substantial part of Asia. They far exceed in number the sheets of the authorized international model in existence at the present day.

The conclusion of the war enabled the Central Bureau to resume its activities. Its first task was to regain touch with the participating nations and to publish a report showing progress made. This report appeared in 1921, and showed that twenty-nine sheets had been published, while about fifty others were reported as being "in preparation." In addition to these sheets, many of which were provisional only, produced by National Cartographic Offices, there were in existence more than one hundred published sheets of the R.G.S. series, and another provisional series covering a large part of South America, which was being prepared by the Engineering Society of Rio de Janeiro to commemorate the centenary of the Republic of Brazil, was nearing completion. The war brought into existence several new states, many of which are keenly interested in the Carte Internationale and are actively participating in its production. The project now counts forty-four adherents.

As to the present state of publication: there are required in all about one thousand sheets to cover the land surface of the Earth, and of these about one hundred consist of seas in which there are small and relatively unimportant islands. Of the remaining nine hundred approximately two hundred have been published in some form or other. Only twenty-one of these conform exactly to the Paris resolutions, but more than one hundred are layered. and do not differ except in detail from the authorized model. The progress made by National Cartographic Offices has not kept pace with that due to the enterprise of private societies and individuals, but it shows signs of improvement. Last year twenty-eight sheets were published by seven countries, including new editions and provisional sheets. This year sixteen countries are engaged in production, and one may hope for proportionately greater progress.

Reviewing 1/M mapping as a whole, and taking into consideration the various provisional series, one may say that the big "gaps" now existing are North America, North-East Asia, and Australia and Polynesia. Political conditions in North-East Asia are such that we cannot expect much progress in that region for several years, but no such extenuating circumstances exist in the other quarters. It is believed that in the U.S.A. at least sufficient topographical material exists to enable the 1/M series to be extended over practically the whole of that country. Such a series exhibiting almost every type of cartography from glaciated mountains, prairies, and deserts, to large towns and industrial areas developed as intensely as in any part of the world would be of more than common interest. It is to be hoped that the more active participation of the U.S.A. in the production of the Carte Internationale will not be long delayed. With regard to Australia, I am glad

to say that the Commonwealth Government have decided to make a start on the 1/M maps of that country, and though topographical information is scanty in many places, one feels that as soon as a beginning has been made there is an increased incentive to progress which before long is sure to produce its due effect.

Having thus briefly surveyed the history and present state of the Carte Internationale, let us turn to the technical aspect and consider some points in the resolutions of 1913 and their results. The first point to which attention may be drawn is the omission from the resolutions of any directions for ensuring what may be called quantitative uniformity in the information shown on the map. On a map of small scale it is impossible to show every existing feature. The map must not be overcrowded with detail. The compiler must select the most important features and omit all others. The resolutions lay down how these features should be shown, but omit directions as to the selection, and we find in consequence a great variety in method resulting in some curious anomalies. From an inspection of the latest sheets only, one might infer that there were more first-class roads in Finland than in Belgium, and that there are more towns and villages in North-East Sweden than in industrial England.

It will not, I think, be contested that, viewing the map as a whole, the amount of detail appearing on each sheet—roads, names, etc.—should be proportioned, approximately at least, to the state of development and the density of population of a region. At the present time this is not the case, and the appearance of each sheet as a whole gives no clear indication of the degree of development or general character of the region.

The same variations appear in the way in which the relief is shown. In some sheets the contouring is elaborated in the greatest detail. In others, with equally complete data available, the smaller bends and loops are omitted, and the contour lines "generalized." Examples of the former are the American and Japanese sheets, and of the latter the sheets produced by India. A comparison of these shows beyond dispute that the attempt to show contour lines in too great detail is a mistake, and that the clearness and artistic effect of the sheet is enhanced by intelligent generalization. It is worth noting also that, although allowed by the resolutions, no country has yet made any use of hachures or hill shading for showing or accentuating ground forms, although many examples exist of the striking and beautiful effects which can be obtained by this method in combination with layer tints.

With regard to the symbols and conventional signs I will comment on two only, the symbol for first-class roads and the symbol for contours. I select these because the original symbols chosen in 1909 were altered at the Paris Conference in 1913, when it was decided to show main roads by a solid red line in place of two parallel fine lines, and to show

contour lines in black instead of brown. The effect of these changes on the appearance of the map is illustrated in a striking manner by the second edition of sheet N O 30 (Scotland) just published by Great Britain. I think there will be general agreement that comparison of the new sheet with the old is all in favour of the latter. In all sheets on which they have been used the heavy red lines by which first-class roads are now shown dominate the sheet in a manner altogether disproportionate to their importance.

The black contour lines are perhap less objectionable, but unless they are very finely and carefully drawn the effect is bad and the contour line receives too much prominence. Particularly is this the case if the contour is not generalized and the smaller turns and bends are shown.

Finally, one may refer to the omission from the resolutions of detailed instructions regulating the co-operation of two or more countries in the production of the same sheet and for the production of "provisional" sheets of those areas in which the present state of survey or exploration does not justify production on the authorized model. Resolutions and agreements on these points are very necessary for the further progress of the project and will presumably form subjects for consideration at the next conference.

In conclusion, a word or two may be added about the Central Bureau and its working. There are two points particularly which I wish to bring out in connection with its activities. In the first place, the Central Bureau is not a distributing office for published sheets, and, in the second, it exercises no authority of any kind over any of the producing offices. Its main function is to keep all concerned informed of the progress being made in other countries and to facilitate interchange of information in good time so as not to delay publication on this account. The correspondence of the Bureau shows that there is a widespread but erroneous impression that it acts as a distributive agency for published sheets. The numerous requests for maps and information which it receives indicate beyond doubt that the arrangements for the sale and distribution of the map are not at all satisfactory, and while this is the case the project cannot achieve the objects for which it was started. The intention of the founders of the map was that the sheets should be sold in all countries at a uniform price (see Resolution 14 (*f*) of 1913), but it was apparently impossible to agree to or to frame detailed instructions for giving effect to this idea. In any case the fact is that prices vary widely and in many cases are unknown even to the Central Bureau. The purchase of 1/M Sheets published in foreign countries is in short a matter of no little difficulty.

Impressed by these difficulties the Central Bureau has for some time past continued to urge upon the producing offices the desirability of appointing duly accredited agents for the sale of their products in the various national capitals. It is to be regretted that so far these repre-

sentations have not produced very much result, and it is hoped that the question will receive the attention it deserves at the next and future conferences.

REVIEWS

EUROPE

A Wayfarer in Unknown Tuscany.— Edward Hutton. London: Methuen. 1925. 7¾ × 5, pp. vii. + 212. *Illustrated.* 7*s.* 6*d. net.*

Lombardy, Tyrol, and the Trentino.— Hugh Quigley. London: Methuen. 1925. 7¾ × 5, pp. xii. + 276. *Illustrated.* 8*s.* 6*d. net.*

Under the Italian Alps.— E. L. Broadbent. London: Methuen. 1925. 7¾ × 5, pp. ix. + 251. *Illustrations and Map.* 8*s.* 6*d. net.*

IT is possible to divide travel literature into two classes: the books that should be read before the visit, and those that ought to be read on the return, if the traveller wishes to prolong his delights. These three books belong to the second. Full of personal impressions and details of history and art, they will attract most when the reader's acquired knowledge enables him to compare opinions and to appreciate to the full the information provided. Mr. Hutton's book, originally published as 'In Unknown Tuscany,' traces the way from Siena southwards to the region of Mont' Amiata, somewhat off the beaten track. He is successful through his style (occasionally marred however by trivialities) in conveying the "marvellous and virile beauty" of this land and its people, among whom stand out the Aldobrandeschi and the strange nineteenth-century mystic, David Lazzaretti.

Mr. Quigley and Miss Broadbent allow their imagination less play, yet they do not stick too closely to bare fact. Both cover some common ground: the former conducts his readers from Bergamo into the Southern Tyrol and back again to Trent, while the latter works south from the Brenner and devotes more attention to the Dolomites. Her book has a geographical essay by Miss Newbigin, which sets out clearly the permanent factors in the region's life. Mr. Quigley is more interested in art than in history, and he is happiest when discussing, for example, the influence of local scenes upon Titian's development.

The New Baltic States.— Owen Rutter. London: Methuen. 1925. 9 × 6, pp. xii. + 274. *Illustrations and Sketch-map.* 15*s. net.*

Mr. Rutter, already favourably known for his books on the Far East, gives us a clear, fresh, and sympathetic picture of the three new Baltic States, with two dozen admirable illustrations, a map, and an index. While scrupulously careful to avoid critical emphasis, even when it might well have been pardoned, he continues to mention innumerable facts—simply as facts—which are illuminating as to the difficulties facing all the States, especially Lithuania. For instance, "out of a population of 120,000 in Kaunas [Kovno] half are Jews" (p. 11); "firebrands have the support of both Germans and Bolsheviks" (p. 34). The geographical difficulties are suggested by such significant comments as that on "the river Jura—the name means 'Sea,' so called because in spring the flood resembles a sea" (p. 70); or that (p. 54) where the author explains how in winter all beasts have to be kept under cover, while in summer—though education is compulsory from the age of eight—the schools are shut from May to September to allow the children to work on the land.

So with regard to Latvia, "whose area is 25,000 square miles, it could contain

both Holland and Belgium" (p. 99); and Estonia (p. 184), "with its 20,000 square miles, is larger than Switzerland and [*? or*] Denmark." There is an excellent account of the difficulties of Latvia—ten years ago one of the chief outlets for Russian trade and centres of Russian industry (metal, textile, chemical)—behind a high tariff wall. The account of Estonia (which we are thankful to see spelled properly) is more popular: it contains many interesting details about the towns, especially Tallium, *i.e.* Taasia lium—"Danish Castle," and the excellence of the food, especially the home-grown "coffee," made of a mixture of wheat and barley, roasted and ground. L. W. L.

Finnland, Estland und Lettland, Litauen.— **Max Friederichsen.** (Jedermanns Bücherei. Abt. Erdkunde.) Breslau: Ferdinand Hirt. 1924. $7\frac{1}{2} \times 5$, pp. 144. 16 *Maps and* 36 *Illustrations.*

This book should prove invaluable to the student of Europe, and might go far towards arousing an interest in the little-known lands of the eastern Baltic region. The progressive character of Finland—more correctly Suomi—is indeed known, but the figures quoted, showing as they do a tenfold trade increase in nine years, give to this knowledge a numerical value which strikes the imagination.

The author touches lightly but surely on the various influences, physical and political, that have served to carve out the destinies of these nations, and foreshadows, in a suggestive way, the possibilities of future development. The descriptions, although compact of information, never degenerate into dullness; the mental picture produced is vivid and stamps upon the mind a certain individuality in each country dealt with, which remains after the supporting details have passed away. The facts are marshalled in good order; the maps, as far as they go, are excellent and the idea of assembling the illustrations at the end, instead of scattering them at random through the text, is saving both to time and temper of the genuine student.

A few criticisms may help a future edition.

The account of the geological history of Finland is rather compressed and, by its conciseness, might confuse the general reader.

The maps, when adapted from other works, do not contain the names most needed for elucidating the text; moreover, the inclusion of a map of Finnish waterways seems desirable.

The bibliography might have been more general, and such fundamental authorities as Högbom's 'Fennoscandia' should have been included.

On p. 107 there is a small misprint: the number 36 should be read 14.

Lastly, it is unfortunate that a strong national bias, displayed in the historical and political passages of the work, may tend to limit its wide acceptance as a text-book. E. G. W.

Das hellenische Thessalien.— **Dr. Friedrich Stählin.** Stuttgart: J. Engelhorn's Nachf. 1924. $9 \times 6\frac{1}{2}$, pp. xxiv. + 245. *Map, Photographs, and Plans.* 24*s.*

This is a very serviceable addition to the topography of ancient Greece. The author has spent two seasons in Thessaly, in 1904 and 1912, and has devoted the scanty leisure of a German schoolmaster to complete his survey of the literature. Naturally he has been interrupted a good deal since 1914, and it illustrates the difficulties of German research workers since the War, that he has to regret his inability even now to include in his map the course of the Salonica railway north of the Pass of Tempe. He has wisely limited himself to "Hellenic" Thessaly, meaning by this that period of continuous and

coherent civilization which began with the occupation of the region by the "Hellenic" Thessalians at the close of the Bronze Age, and ended with the barbarian inroads of the early Byzantine centuries. For the preceding period, the prehistoric sites have been discussed already in Wace and Thompson's 'Prehistoric Thessaly' (Cambridge, 1912), and the literary allusions by T. W. Allen in his 'Catalogue of the Homeric Ships' (Oxford, 1921). Fully documented as the present work appears at first sight to be, Dr. Stählin warns us that it must be supplemented, for individual sites, by the series of articles which he is contributing to the *Realencyclopädie* of Pauly-Wissowa. The map is well rendered, from the best available material, and there are careful site-plans mostly from the author's own surveys. The photographs give an excellent impression of characteristic land-forms; and the tabular comparisons of some previous attempts to locate disputed sites a no less vivid glimpse of the pitfalls of Thessalian topography. But the price, twenty-four shillings for a little over 240 pages, does not accord with current legends of German cheap printing!

J. L. M.

My Wanderings in the Balkans.— Dudley Heathcote. London: Hutchinson & Co. $9\frac{1}{2} \times 6$, pp. 328. *Illustrations.* 21*s. net.*

The title of this book does not convey a very precise impression of its contents. "Wanderings" seems a large term to apply to a journey on which the traveller rarely left the main highways, and the fact that a full half-page is devoted to a disappointment in connection with a single meal suggests that there were reasons for a more definite limitation of the range of travel than would be expected from the title-page. It is, further, difficult to understand what precise geographical significance Mr. Heathcote attaches to the word "Balkan." In an introductory section, headed "The Balkans," he gives a list of the "Races scattered all over the region." This list includes, amongst others, Poles, Czechs, Slovaks, Magyars, Ruthenians and Germans, but excludes Albanians, Greeks, Vlachs and Montenegrins. In the body of the book we have chapters on the kingdom of the Serbs, Croats and Slovenes, Bulgaria, Turkey and Romania, despite the fact that the last country officially resents the appellation of Balkan. Greece is omitted, but the real surprise comes with the inclusion of chapters on Hungary and Czecho-Slovakia. It would almost seem as if the author had taken the gibe about the "balkanization of Europe" so seriously as to overlook the fact that the word "Balkan" has a definite geographical meaning.

Certain chapters of the book, we are told, have already appeared in the daily press and in other periodicals, and since the author had interviews with a number of important personages in the countries visited, the assumption is that he went primarily as a journalist. Many of the interviews are described in great detail, questions and answers both being given, and the persons interrogated show a disconcerting tendency to adopt Mr. Heathcote's own style, which is definitely journalistic. The geographer as geographer will thus not find a great deal to interest him in the book. But its author knows his craft too well to be dull, and the volume contains some thoroughly entertaining tales of present conditions in the areas visited. The chapter entitled "Forms of Backshich in Many Lands" may be mentioned in particular, while the account of Bucharest as seen by the traveller is very amusing. There is also an interesting account of an expedition to Rilo Monastery. The illustrations, from photographs by the author, are striking and very well reproduced.

M. I. N.

ASIA

Through Inner Deserts to Medina.— The Countess Malmignati. London: Philip Allan & Co. 1925. 9 × 6, pp. 188. *Illustrated.* 10*s.* 6*d. net.*

The *bona fides* of this vague sketch of a singular journey will probably be doubted by some readers both scientific and general, and for such doubts the authoress will have to thank only herself in the first place, and her proof-readers in the second. She never gives a date, and from the mention of a *vali* in Damascus we presume that the occasion was before the War. She leaves her route from Palmyra southward almost "in the air," and evidently has retained very little memory of what and where she passed. The difficulty of following her is increased by typographic distortions of many of the few names that she cites. She writes of herself as one knowing and fluently speaking Arabic, but she perpetrates most curious sins both of commission and omission, the most unaccountable of the former class being her description of the et-Tayar sheikh who conducted her all the way from Damascus to Zilfi. She calls him Sultan or Supreme Prince of the Roalla tribe, a position which is and long has been held only by the Shaalans. The Tayars are chiefs of a wholly different tribe, the Wuld Ali. Nor has either tribe a "Sultan." The man, no doubt, had, as is often the case, Sultan for his proper name and was of the Tayar line of the Wuld Ali. If an authoress makes so serious a mistake as this at the outset, she cannot complain if her whole journey is doubted; and the doubt will be strengthened when, later on, the reader finds the lady writing thus of a tribal migration of four thousand tents with all the women and children (her own figures), which she accompanied day after day on a trek of many hundred miles.

"Our dromedaries seemed to fly along. We covered sixty miles each day."

Even if she means us to understand that three-quarters of those miles were covered in excursions off the line of the main march, the fact remains that the "dromedaries" would have foundered in two days, and probably the lady herself in one! Sins of omission are many; the worst lie in utter absence of any sign of knowledge into whose jurisdiction she had come at different stages, *e.g.* at Zilfi, at Boreidah, at Hanakiyah (at all of which places she encounters *Kaimmakams* (*sic*)), and in her lack of description of the towns through which she passed, notably Boreidah, the largest city of Central Arabia. At Zilfi she mentions little but minarets as being visible from a long distance and numerous presumably as in a Turkish town. Is there in little Zilfi, a dour Wahabite place, more than one minaret, and is that permitted to rise 10 feet above the low mud roofs?

Adding up improbabilities and impossibilities, one might easily sum up wrong—that from Palmyra, at any rate, onwards all is fiction and mystification—all this narrative of unlikely conversations and Arabian Nights Entertainments, and high falutin' about the desert at dawn and the camel and other *cliché* subjects. But omission to keep any serious diary, the long lapse of time before the journey was written up, the authoress's lack of Arabic and dependence on a sheikh and on others who, as the narrative unconsciously betrays, were exploiting her ignorance for all she was worth, and probably had about as much intention of facing the Ruba al-Kali with her as of going to the moon—these considerations will explain pretty nearly all the mistakes; while the life-like pictures given of the behaviour of those people and, after their prudent secession, of the others who controlled her movements, go far to prove the reality of her journey, and there are more positive arguments to clinch it. They are based on the place-names, few though they be, where she

records halts. Having come through the deserts of Wadian and Dahna (" Dalma," by doubtless the uncorrected error of a transcriber) with an Anazeh sheikh, bound, whether he were of the Wuld Ali or the Roalla, to bear well over to eastward of any Shammar *dira*, she arrives at the wells of Umm el-Fahud (the book prints Umm el-Fahnd by an obvious typographic blunder) near a Wadi al-" Umstarri." Umm el-Fahud is a real point on a road from Koweit to Zilfi, situated just where a southward-bound caravan which had skirted Shammar territory on the east would be likely to strike a Zilfi road. At the same time it is a most obscure watering-place, whose name would not conceivably have occurred in the narrative of any one who had not halted there ; and this being so, it is probable that " Umstarri " disguises some real name of a neighbouring *wadi* or *shaib*, perhaps that of the local Shaib Umm Shaltar. Again, on the road from Boreidah to Rass, the authoress mentions " Shabitiyah," a very obscure village which is in fact Shabibiyah, at the junction of the Mecca road with that from Medina ; and between Rass and Hanakiyah the narrative gives more real and not less ill-known names—Zirziwiyah, (Jirzawiyah) ; Marwiyah, which is the camping-ground under Jebel Mawiyah ; and a name " Babin el-Churah," which seems to be the *mashash* of Batin el-Urmah, distorted by transcribers or printers. The Rass-Medina road is even less well-known than the Koweit-Zilfi track, and neither is described in any book which the authoress is the least likely to have consulted. We have not the smallest doubt that she did, in fact, pass along both roads.

Her southward route from Palmyra to Umm el-Fahud is new ; her route from Rass to Hanakiyah stood badly in need of better description. But, unfortunately, the Countess Malmignati's account of her roads amounts to practically nothing ; and for general descriptions one is shy of trusting her visual memory. So geography gains practically nothing by this book.

D. G. H.

Palestine of the Mandate.— **W. Basil Worsfold.** London : T. Fisher Unwin, Ltd. 1925. 9 × 5½, pp. 269. *Thirty Illustrations and Three Maps.* 21*s. net.*

The title of this book is happily chosen : it fully describes its purpose and contents. It contains not only brightly written descriptions of journeys over oft-trodden routes, but it gives in a popular form the salient facts of the peculiar political and economic position of Palestine to-day. It is a sober and well-reasoned answer to the question, " What is England doing to justify our mandate in Palestine ? " While giving the fullest praise to the band of accomplished administrators who have done, and are doing, so much for this land, the book clearly demonstrates how at every turn, and in all departments, the accomplishment of their justifiable ambitions for Palestine is curtailed by the economic difficulties.

The most important chapters are concerned more with political and economic problems than with geography. Thus, after an opening discussion upon the whole position of Great Britain and the Mandate and the Balfour Declaration, there are chapters full of much timely information regarding " Law and Order," " The Economic Position," " Safeguarding the Monuments," " Agriculture," and " Education and Health." The facts here given are essential to all those who would try to understand Palestine under the Mandate—its present and future position—and yet we venture to think that they are little known outside official—and Zionist—circles.

The author's views on the Zionist question are sober and rational. He does not shut his eyes to the difficulties, nor is he carried away by any senti-

mental optimism. One feels on reading this book that the British Administrators have so far held the scales most evenly between Arab and Jewish claims, and also that a properly directed and controlled Zionism may be of inestimable benefit to the land as a whole, in which benefit the Arab will gain as much as the Jew. Neither the British Government nor the Arab population of Palestine are prepared to finance the schemes of development without which this derelict land—once so prosperous—cannot be made a place worthy of its historical importance in the world. The description here given of the Jordan water-power scheme, known as the Rutenberg Concession, is illuminating. It seems the only immediate solution of the economic difficulties. "The Mandatory Power had to do two things. It had to improve the material conditions of the people and the country and to train the people to live together peaceably and to govern themselves. The indaequacy of the revenue at the disposal of the Administration made both tasks difficult. . . . In these circumstances the only remedy for the immediate situation was the development of the natural resources of the country by external capital. If an appreciable expansion of production was once secured, the resultant increase of revenue would enable the Administration to take its proper position as the chief agency of material progress." And this progress is the best method of securing that co-operation of Jew and Arab "in everyday work on undertakings of mutual benefit in town and country." The economic problem is therefore closely connected with the political, and the development of the natural resources of the country is the likeliest means of solving both.

It only remains to add that the sketches and photographs greatly add to the attractiveness of an unusually fascinating book. E. W. G. M.

The Heart of the Middle East.— Richard Coke. London: Butterworth. 1925. 9 × 6, pp. 320. *Illustrations.* 18*s. net.*

Mr. Richard Coke gives a concise outline of Iraq history, and also a sketch of the country, its inhabitants, and the problems confronting it at the present time. Coming at a time when the Mosul question looms large, the book will be doubly welcome.

Mr. Coke shows that the population is divided, through racial and religious causes, into several distinct communities. "The problem of modern Mesopotamia is less an Arab problem than a question of fitting the various types of resident Iraqi with something approaching a general national consciousness." In relating the modern history of Iraq, the author insists upon the importance of the capture of Hormuz from the Portuguese by the combined English and Persian forces in 1622. This event, he points out, gave the English a foothold in the Persian Gulf, and was thus the real beginning of the British connection with Iraq.

The book deals at some length with the period just before the War, when German, Russian, and British interests were intriguing against each other. In the chapter on the war itself, a good case is made out for the Mesopotamian Expedition, but in the post-war portion of the book we are shown how the disappointments following the Armistice led, in combination with Turkish propaganda and Shi'ah bigotry and hostility, to the 1920 rising.

The most interesting chapter of all describes the various nationalities and sects that are to be met with in Iraq. It would have been an advantage if some photographs of these different types could have been inserted here. But the photographs which the book does contain are excellent.

Mr. Coke pays well-deserved tributes to the efforts, both British and Iraqi, that have been and are being made to set up and maintain in running order the

machinery of the new state, and he praises the work of the Royal Air Force and the police. Though opposed to the Mandate idea, he is quite definite that Iraq cannot yet stand alone, and he thus favours a continuance of the British connection. To use his own words, Iraq " . . . if left to herself . . . is almost certain to become the battle-ground between the rival claims of Arab and Turkish nationalism ; and here the powerful influence of the Wahabis, fostered by their ever-watchful chief Ibn Saud, must not be overlooked."

E. H. K.

Wild Ceylon.— R. L. Spittel. Ceylon: The Colombo Apothecaries Co., Ltd.; London: Simpkin, Marshall, Hamilton, Kent & Co. 1924. 9 × 5½, pp. 260 + 89. *Illustrations and a Map.* 12*s.* 6*d. net.*

This book is an account of several expeditions into the up-country jungles of Ceylon, undertaken by the author primarily in order to obtain first-hand information as to the customs of the Veddas, the survivors of the island's aboriginal cave-dwelling inhabitants. Mr. Spittel found the Veddas shy and elusive, and although his persistence enabled him to get in touch with most of them, he has been able to add little to our knowledge of this ancient race beyond what Professor and Mrs. Seligman have recorded in their book 'The Veddas.' He comes to the melancholy conclusion that to-day hardly a Vedda true to the old traditions survives, and that the effects of civilization and intermarriage with the neighbouring Sinhalese or Tamils are causing the race to die out, for there is almost certainly no pure-blooded Vedda alive to-day. Nowadays the Veddas do not depend, as formerly, solely on the jungle for the necessaries of life, but nevertheless they still retain much of the forest lore of their forefathers. Many of them are still marvellous trackers, and Mr. Spittel's most interesting chapter is his account of the audacious manner in which these primitive folk collect the edible birds'-nests from fearsome caverns and dizzy ravines, and with supreme daring gather wild honey, particularly that of one species of bee which builds high on the precipitous sides of great rocks.

Perhaps the most engaging thing about Mr. Spittel's book is his enthusiasm for jungle travel, which, with proper arrangements, he considers " as easy as a walk out-of-doors after dinner "—a somewhat unwise doctrine for those newcomers to whom his otherwise excellent travel notes are addressed. The book has a map showing the author's journeys, but it is unfortunate that the illustrations could not have been better reproduced.

O. R.

Aerophoto Survey and Mapping of the Forests of the Irrawady Delta.— R. C. Kemp, Major C. G. Lewis, R.E., C. W. Scott, D.F.C., and C. R. Robbins, M.C., D.F.C. (Burma Forest Bulletin No. 11.) Mayma: Supt. Government Printing, Burma. 1925. 13 × 8½, pp. 44. *Maps and Illustrations.*

To the surveyor working on foot the mapping of the delta of a great tropical river presents a problem of the utmost difficulty. In fact, it may almost be said in some cases, of which this is one, that the problem is insoluble.

We have here 1440 square miles of deltaic forest, thus described: " Wide waterways with a rapid current ebbing and flowing with the tide ; mud banks in which at every step the surveyor sinks to the knees or even further . . . ; small creeks only navigable at high tide in small boats . . . ; on the so-called land . . . a dense tangled undergrowth through which every step has to be cut."

Viewed however as a subject for aerial survey, this seemingly impossible tract actually offered certain special facilities. It was absolutely flat ; it was within reach of civilization (being only one hour's flight from Rangoon) : the

"detail" to be mapped consisted entirely of rivers and creeks; and, lastly, the profusion of large rivers provided safe landing-places in all parts of the area. The "difficulties" of the survey narrowed down in fact to the question of providing an adequate "control" on which to assemble or plot the photos. This work was carried out by the Survey of India under conditions of exceptional difficulty. The photographs were taken by a private firm working under contract, and the final map on a scale of 3 inches to 1 mile was prepared by the Survey of India.

Photographs were taken in straight flights and compiled into mosaics by strips adjusted to the control. Oblique photographs were not used. The maximum error in any part of the work is estimated at 5 chains. The cost worked out at Rs.273.7 (£18 5*s*.) per square mile, of which Rs.210.4 (£14) was the cost of photography. The estimated cost of a ground survey of the same region is put at Rs.500 per square mile. The aerial survey, in addition to effecting a notable saving in cost, has been found to provide valuable data for classification of the forest growth. M. N. M.

AFRICA

Les Touareg du Niger : Les Oulliminden.— **Dr. A. Richer.** Paris: Emile Larose. 1924. 10 × 6½, pp. 359. *Illustrations and Map.* 9*s*.

With the exception of the works of de Foucauld and Jean very little of an authoritative nature has been written about the Tuareg. The present work by a doctor of the French colonial army is a valuable contribution to our knowledge of this predatory desert people, of whom the Ulliminden eventually became the predominant tribe. The book contains little of interest to the anthropologist, but to the student of history it will prove of great value. Dr. Richer traces the Tuareg back to the Berber Lemptas of the Mediterranean littoral whence they migrated southward across the Sahara, one section, from which the Ulliminden sprang, settling in the region of the Middle Niger.

The prevalence of the cross as an emblem amongst the Tuareg, and much similar evidence, has led to a wide belief that they were Christians before their conversion to Islam. Dr. Richer adduces many interesting arguments on both sides, but in spite of diligent researches he appears to have reached no definite conclusion. He has carefully examined the Arab authors and deals fully with early Tuareg history. He has much of interest to say about the great desert market of Tadmekka, which disappeared before the encroaching dunes and has only recently been re-discovered.

The period of Ulliminden history of most interest is the seventeenth and eighteenth centuries. The southern Tuareg had for long been dominated by the powerful Songhai people and had supplied them with large numbers of fighting men. When the Songhai state was destroyed by the Moorish army of El Mansur the Tuareg gained their freedom. The separation of the Ulliminden as a distinct tribe dates from this period. First they allied themselves with the invader, but finally fell into subjection. Their nomadic habit of life, however, enabled them to escape extinction, and when the remnants of the Moorish army finally cut themselves off from Morocco and sank into decadence on the Niger the Ulliminden became their masters. Dr. Richer's account of this period is the most valuable part of his book.

The second half of the volume deals with the history of the Ulliminden since the French penetration at the end of last century. It is a record of constant revolts, the copious details of which make tedious reading. The only outstanding figure is Firhun, the powerful Ulliminden chief through whom

the French endeavoured to control the tribe. Firhun's protestations of friendship were eventually found to be false. Revolt followed revolt up to the time of his death in an intertribal affray in 1916. The Ulliminden continued to resist for some time afterwards, but they appear to have been brought under administrative control at last.

Dr. Richer has provided his readers with a good bibliography, and he gives copious references to his authorities throughout the book. Unfortunately there is only one map and that not a good one. Frenchmen have a great aptitude for producing books of this excellent character, but when will they learn that by omitting an index they deprive their exhaustive industry of half its value? M. Delafosse set an admirable example at the end of his 'Haut-Sénégal-Niger,' but so far his subordinates have failed to follow it.

E. W. B.

In the Sun with a Passport.— W. R. H. Trowbridge. London: Hurst & Blackett. 1925. Pp. 287. 25 *Full-page Illustrations*. 18*s. net.*

This vague title is that of a chatty account of a visit to well-known places in Algeria and Tunisia. The writer's descriptions and historical pictures of Tunis, and especially of Qairwan, which is glowing with real artistic insight, are so good that one greatly regrets that other places are so often treated merely as pegs upon which to hang conversations with chance-met tourists, rather jejune reflections, and opinions on things in general. This ill-judged padding is deliberate, always tiresome, and certainly vastly out of proportion. Even where the writer does keep to description and history this is a book more suitable to be read aloud to an interested companion to recall happy days than one for serious study; and for the former purpose is somewhat dear at its price.

W. C. P.

AMERICA

Trail Life in the Canadian Rockies.— B. W. Mitchell. New York: Macmillan Company. 1924. 8 × 5½, pp. xii. + 270. *Illustrated*. 12*s.* 6*d. net.*

With Shot Gun and Rifle in North American Game Fields.— Capt. Beverly W. Robinson. New York and London: D. Appleton & Co. 1925. 8½ × 5½, pp. xiv. + 388. *Illustrated*. 15*s. net.*

Both these writers aim at encouraging their readers to escape, at least now and again, from the bonds of civilization, to live what one of them describes as "the care-free life of primitive man." As a matter of fact, simplicity is not always the characteristic of their trips, with their elaborate organization, guides, and pack trains. However, Mr. Mitchell succeeds in imparting to the reader something of his own enthusiasm, the result of nine seasons' trekking and climbing in the Rockies and Selkirks. He writes in overflowing spirits, and peppers his pages with words such as trappers, cayuses, squaws, horse wanglers, and flapjacks, terms one generally associates with a different and past phase of American life.

Capt. Robinson deals systematically with the small and big game of North America. He holds that killing large bags of game is not the sum-total of sport with gun or rifle, consequently, though he gives much technical information, he writes interestingly of his hunting trips, ranging from Labrador to the Rockies and Alaska. Both writers give chapters on outfit and procedure.

Sixth Census of Canada, 1921. Vol. I. Population, Number, Sex and Distribution—Racial Origins—Religions. Ottawa: Dominion Bureau of Statistics. [1924.] $9\frac{1}{2} \times 6\frac{1}{2}$, pp. xlvii. + 859. $1.

This is the first of six volumes which are to give the final results of the most complete census of population and agriculture yet attempted in Canada, and the text which precedes the tables gives a brief account of the development, objects, uses, and scope of the census, which is of great value to the student of census results. A census is well described as a periodical stocktaking. Its fundamental part is the enumeration and analysis of the man-power of the State. Much statistical matter for national stocktaking is obtained from registration of births and deaths, of numbers of employees, of school enrolments, and so on. But all this needs to be checked by a periodical census. It is also interesting to note that the Census of Canada was deliberately synchronized with those of other states of the British Commonwealth. The last intercensal period included the Great War and the 1921 censuses measure some results of that event. For instance, the increase of population in Canada was 21·95 per cent. as against 34·17 per cent. in 1901–11. Yet this increase was second only to that of Australia for the same period (22·29 per cent.). The drift to the towns which is now widespread affects Canada as well as older and more densely peopled lands. Practically half the population is "urban" (49·52 per cent.), and the growth of urban population is particularly marked in the larger cities. The rural population has increased for the whole Dominion; but three eastern provinces—Prince Edward Island, Nova Scotia, and Quebec—record decreases, as do also several counties in the older parts of Ontario. Canada has yet no "million-city," but both Montreal and Toronto have passed the half-million; and the former, with its suburbs, seems likely to have a million people by the date of the next census (1931). Yet there are only six large cities, *i.e.* with more than 100,000 inhabitants each, and these, together with Quebec (95,193), contain about a fifth of the total population.

In the tables recording racial origins, the reference is to the country of origin of the ancestors of all the people other than the aboriginal Indians and Eskimos. The numbers of Canadian-born and of immigrants will be recorded in a later volume. The changes in European boundaries resulting from the war have given rise to changes in the meaning of some terms, as *e.g.* Austrian, which make some 1921 figures no longer comparable with those of earlier censuses. We note that Ukrainians are recorded separately, but not Ruthenians. The tendency of some peoples to settle in clusters is indicated in such figures as those for Rhineland (Man.), of whose 8400 inhabitants 7441 are Dutch; Calder (Sask.) with 3008, of whom 2355 are Austrian; Weldon (Sask.) with 2115, of whom 1567 are Scandinavian; and Wostock (Alta.) with 3766, of whom 3215 are Ukrainian. These also indicate some difficulties in the Canadianization of such immigrants.

On p. xxxv. there is a note on the effect of errors in enumeration on the representation of the various provinces in Parliament, to determine which is a primary purpose of this census. It would add greatly to the value of the Report if the responsible authorities would also give an estimate of the probable margin of error in their results—in various sections and in the whole. What, *e.g.*, is the value of the precise figure 3242 for the number of Eskimos in the N.W.T.? It is probable, on *à priori* grounds, that the figures for such areas are less reliable than those for more populous and civilized areas. But even in the best cases there is some possibility of error. It is certainly difficult, and it may in practice be impossible, to give a useful estimate of the probable

error. So far as the present writer is aware it is not done in any important census report; though there is a useful discussion of some sources of error in Sir G. H. Knibbs' 'Mathematical Theory of Population,' which was published as an appendix to the 1911 Census of Australia. If the remaining five volumes keep up to the standard of fullness of detail set by this first one, they will justify the claim that Canada has now one of the most complete census records known. C. B. F.

My Eskimo Friends, "Nanook of the North."— R. J. Flaherty. New York: Doubleday, Page & Co. 1924. 10 × 7. Pp. 170. *Maps and Illustrations.* $5.

Mr. Flaherty is known for his travels in Arctic Canada and in particular his exploration of the Belcher Islands. Until his survey of these islands in 1915–16 they appeared as tiny islets on the chart of Hudson Bay, while in reality they are of considerable area. Long known to the Eskimo of the mainland, they were unexplored until Mr. Flaherty visited them in search of iron ore. Strange to say, a seventeenth-century map shows larger islands, roughly in the position of the Belcher Islands, than a twentieth-century Admiralty chart. The data for these islands on the charts were based on notes supplied in the middle of the eighteenth century by Captain Coats, who sailed annually along the east of Hudson Bay. Mr. Flaherty's account has already been published in detail in the *Geographical Review*, June 1918, which may explain the meagreness of the account in the present volume. Another section of the book deals with the author's two crossings of the Ungava Peninsula in 1912. These were also described in more detail, with a large-scale map based on compass traverses, in the *Geographical Review*, August 1918. A final section describes the making of the famous film of Eskimo life, the first attempt in Baffin Land, and the final success on the Walrus Islands and round about Cape Dufferin. The book gives some well-written sketches of Eskimo life, and contains a good deal of adventure, modestly told, but it is not strong in geographical matters. The maps are adequate, and the illustrations—some by Eskimo artists and some in colour—are admirable. R. N. R. B.

The West Indies.— George Manington. London: Leonard Parsons. 1925. $8\frac{3}{4} \times 5\frac{1}{2}$, pp. xvi. + 304. *Illustrations and Map.* 15*s. net.*

This pleasantly if lightly written volume covers a good deal of ground, for in addition to the West Indian groups of islands the author takes in British Honduras and British Guiana. Within the compass of a few hundred pages no more could be done than Mr. Manington has attempted—to give a series of rapid descriptions, a sketch of history, and to infuse the whole with the always attractive atmosphere of personal travel. There are but few readers of books who do not relish the picture presented at first hand, and in these pages there is a constant reminder that the author had called at every port, short though his stay may have been and but small his acquaintance with the problems of the islands.

The picture given in the book is attractive, and its attractiveness and atmosphere of verisimilitude is enhanced by the excellence both of choice and reproduction of illustrations. The map, too, is a good piece of work; the index is excellent. A foreword by Lord Olivier, who knows the West Indies so well and sees these groups with broad vision, adds to the interest of the volume. L. E. E.

Handbook of the Leeward Islands.— Frederick Henry Watkins, I.S.O. London: The West India Committee. 1924. 8¼ × 5¼, pp. 308. *Illustrations and Map.* 10*s.* 6*d. net.*

Mr. Watkins' compilation serves a useful purpose. He gives a brief outline of the history of this group of islands, a list of Governors, a bibliography, an economical survey and physical description; and, since these regions depend almost exclusively upon the products of agriculture for their living, he wisely devotes many pages exclusively to agricultural industries, to the work of Botanic Gardens, and of the Imperial College of Tropical Agriculture which, although situated not in the Leewards but in Trinidad, plays an important part in the progress of all the British West Indian Islands.

Details of trade statistics, customs dues, steamship communications, and postal information will all be found here; the map is adequate and the index good. One could, however, have spared some of the photographs of Government Houses in exchange for more views of the enchanting scenery of a delightful island group, endowed with luxurious verdure and a climate whose very memory is enough to make a London fog appear less dense.

L. E. E.

AUSTRALIA AND PACIFIC ISLANDS

The Foundation and Settlement of South Australia, 1829–1845.— A. Grenfell Price. Adelaide: F. W. Preece. 1924. 9 × 5½, pp. xii. + 260. *Sketch-map, Plans, and Illustrations.*

Mr. Price maintains that the early history of South Australia has been misinterpreted owing to "the concentration of attention upon the political and the neglect of the geographic and economic aspects of the story." To these, therefore, he proceeds to give his main attention. He relates the story of the location of the settlement, and gives great credit to the Surveyor-General, Colonel Light, for his selection of the eastern edge of the Rift Valley. "The later history of the State makes it difficult," he writes, "to discover any other locality in which colonization had a similar chance of success." He then discusses the country surveys and finds the primary cause of the colony's disasters during the early years in "the inadequacy of the Commissioners' survey arrangements, which for nearly two years rendered the occupation of country lands for all purposes except pasturing an impossibility." Hence the town grew in numbers while the country round was relatively empty. Other difficulties there were, as "the failure of many of the early colonists to understand the peculiar Mediterranean environment and to adjust agricultural pursuits to its needs." For these reasons production did not keep pace with the influx of population, and the capital of the colony was expended on the importation of food. He sketches the work of Gawler, the development of the difficulties, the crisis and recovery. His treatment throughout is clear and suggestive, and emphasizes neglected sides of this interesting story.

E. A. B.

Tahiti: Isle of Dreams.— Robert Keable. London: Hutchinson & Co. 1925. 9 × 6, pp. 223. *Sixty Illustrations.* 16*s. net.*

Mr. Robert Keable utters a weighty platitude when he says in his Preface, "Of the making of books upon the South Seas there is no end." He himself, he admits, thought at first that of books about Tahiti in particular there were enough, and some of his readers may be inclined to agree with him, anyhow until they reach his last chapters, wherein he records his personal impressions and convictions; these are worthy of attention, since he writes of the island

as it really is and so is one of the few writers on the South Seas who has not been carried away by romance that is too often superficial.

Mr. Keable's earlier chapters are mainly descriptive, but the thread that binds them together is his attempt to render the impressions made by the island on men such as Pierre Loti, Gaugin, Calderon, Rupert Brooke, and Stevenson. A score of writers have sought in Tahiti the fulfilment of a dream, but those dreams have never before been gathered together. Mr. Keable is however more than a mere anthologist, and more, too, than a passing traveller attempting to describe the indescribable. He realizes, clearly enough, the tragedy of the island race that is so fast dying out—he doubts if there are now five hundred inhabitants of the old Tahitian blood—a fate begun by Western disease, alcohol, and gunpowder, and ended by Western commercialism. With the Tahitians has died the Tahiti of romance. The tourist of to-day sees no more of the real Tahiti of the past than he would see at a colonial exhibition. He will find neither amorous adventure nor primitive simplicity; nor will he obtain for nothing every material necessary. In Tahiti to-day the fruits of the Earth are no longer held in common. The gods of Tahiti to-day are the gods of civilized men. O. R.

Australien und Neuseeland geographisch und wirtschaftlich.— Kurt Hassert. Gotha-Stuttgart: F. A. Perthes A.-G. 1924. $8\frac{1}{2} \times 5\frac{1}{2}$, pp. viii.+178. *Sketch-maps and Diagrams.* 4 *M.*

This is an enlarged edition of a work originally published in 1907 in the *Sammlung Göschen.* The economic side has been considerably expanded, and a further section on New Zealand added. In this form it is intended to be of use to German business men as well as to students and teachers. The author has evidently been at pains to make himself thoroughly acquainted with recent literature, and he includes a comprehensive, but unclassified, bibliography. The ground is covered in three sections: the Land, the People, and the Economic Life. The first virtually describes the hindrances to be overcome rather than the natural advantages, the second the people who are overcoming them, and the third the measure of their success. On the whole, Prof. Hassert treats all the problems facing Australia concisely and impartially. Very occasionally he abandons his objective attitude, to jibe at the Australian Press, or to lament the "Anglo-Saxonization" of the German settlers. Most of his criticism however is fair. There are several sketch-maps in the text, none of which possesses a scale or shows the physical features. G. R. C.

Sterbende Welt. Zwölf Jahre Forscherleben auf Neuseeland.— Andreas Reischek. Herausgegeben von seinen Sohn. Leipzig: Brockhaus. 1924. $9\frac{1}{2} \times 6$, pp. 334. *Illustrations and Maps.*

This volume is the diary of Andreas Reischek, edited by his son in pious memory of his father, an Austrian who, on the recommendation of Ferdinand von Hochstetter, under whose notice the young man by his interest in natural history had come, was brought out in 1877 to New Zealand by Sir Julius von Haast as taxidermist and preparator for the newly erected Canterbury Museum in Christchurch, of which Haast was Director. Here, after spending two years, Reischek embarked on a wandering life, for ten years more, over the colony and the outlying sub-Antarctic islands in quest of specimens of their dying life—which gives the book its title—for the various provincial museums and for Vienna—especially of the avifauna, which he enriched by one or two new species. The diarist, a more or less self-educated man, appears for his private edification to have religiously entered his doings in great detail in his day-book, during

his numerous excursions. He was successful in acquiring an astonishingly extensive and valuable biological and ethnographical collection, with which he returned to Austria in 1889. On his death in 1892, at the age of fifty-seven years, Reischek left his " Tagebuch " to his son, who, unaware of what was not of real interest in its contents, has now, twenty-two years after his father's decease and thirty-five years after its writer's departure from New Zealand, given to the public this record without the blue pencilling that an editor with knowledge of the country would have been wise to have exercised. A sympathetic spirit pervades Reischek's narrative of his journeys amid the very attractive and remarkable features of the Dominion: its west coast fiords, its snow mountains—one of whose glaciers in the South Island, of which an aquatint by Haast is reproduced in the book, bears Reischek's name—its kauri forests, its geysers, and its bleak outlying islands; while his happy relations with the Maoris, then not altogether quite friendly with the European settlers, speaks highly for his amiable nature. It is hardly to be wondered at if the volume (which is well produced and illustrated by excellent but now familiar photographs) is found to contain little that is now unknown about so intensively explored a country as New Zealand. H. O. F.

POLAR REGIONS

Hunting and Adventure in the Arctic.— F. Nansen. London: J. M. Dent & Sons, Ltd. 1925. 9½ × 6½, pp. 462. *Illustrations and Chart.* 15*s. net.*

The basis of this book is Dr. Nansen's first voyage to the Arctic when he sailed in 1882 in the whaler *Viking* to the Greenland Sea, but that voyage is used mainly as a framework on which he has built a volume dealing with many aspects of the Arctic in the light of his long and varied experience. To some extent the title is unfortunate and fails to do justice to the book, which is a real contribution to our knowledge of Arctic regions. The chapters on drift ice and polar currents are specially valuable in summarizing and adding to information about the pack-ice off the east coast of Greenland and around Jan Mayen. Dr. Nansen points out that since pack-ice drifts in the polar current it is impossible for any appreciable warmth to be transferred to it from below, except on the borders of the current where the ice may drift into warmer water. The result is that summer melting of ice is almost exclusively due to heat which comes direct from the sun. The ice melts above and not below except in so far as the lanes of water in the pack may be temporarily warmed by the sun and so melt the ice along its edges and under surface. Dr. Nansen combats the idea that the melting of great masses of ice in the Greenland Sea cools its surface layers. The summer melting leads to a great deal of heat being imprisoned and a consequent delay in the heating of the sea and air by the sun's rays. But in winter this heat is released and delays the cooling of the sea surface and the air above it to the same degree. Thus, he contends, this ice has little effect on the dynamics of the sea in the production of great ocean currents.

From a remarkable similarity between the course of the drift of the *Viking* when beset in the ice in the summer of 1882 and that of the ice-floe on which the *Hansa's* crew drifted in the end of 1869, Dr. Nansen has endeavoured to draw a chart of the currents in Denmark Strait, but in the lack of detailed bathymetrical information his results are tentative. To the north-east of Iceland shoal water extends to Greenland. This turns the warm Irminger current mainly to the west because it has no space to turn east, and the cold Greenland current in the same direction. The result is a vortical movement between the

two currents in the strait, and the ice is drawn near the banks off the Greenland coast where the current contracts and its speed increases.

A large part of the book is occupied with an account of the habits of the saddleback or Greenland seal, or, as the Newfoundlanders call it, the harp seal, the breeding grounds of which were found in the " North Bay," as the whalers call the great bight in the pack-ice that lies to the north of Jan Mayen. It is caused by the impingement of a great eddy of the North Atlantic drift sweeping northwards to Spitsbergen. Other chapters give the best natural history of the polar bear ever written.

The book is fully illustrated by the author's own charming sketches Unfortunately it lacks an index and is marred in places by American spelling, including a *z* in Spitsbergen, a usage never followed in Norway.

R. N. R. B.

MATHEMATICAL AND PHYSICAL GEOGRAPHY

Aerial Surveying by Rapid Methods.— B. Melvill Jones and **Major J. C. Griffiths.** Cambridge: University Press. 1925. 10 × 7, pp. xiv. + 160. *Map and Illustrations.* 16*s. net.*

At a time like the present, when the necessity of developing the " blank " spaces of the Empire is becoming daily more evident and more pressing, the appearance of this book is most opportune. The first requirement for systematic development of a region is reliable and detailed knowledge of its topography, but the task of obtaining this knowledge and recording it in the form of a map has hitherto entailed financial and administrative efforts beyond the powers of the Governments of a poorly developed country. It has been clear for some time that in aerial photography there lay possibilities of effecting economies both in time and cost of such surveys which might bring them into the field of practical politics, but doubts as to procedure, cost, and accuracy have, in the absence of actual experience, combined to postpone the trial of the new method.

The authors of this book set themselves the task of investigating the possibilities of aerial photographic methods in respect to the mapping of unexplored or unsurveyed regions of considerable extent. They expressly exclude from their work all methods in which the photographs are plotted or adjusted singly, and they postulate a ground " control " of points spaced at intervals of from 10 to 50 miles. The problems discussed and investigated by them are :

(1) How best to ensure photography of the whole area with a minimum of flying.

(2) How to arrange the photography so as to reduce to a minimum the ground work necessary to control it.

(3) How to deal with the photographs when taken, and adjust them to the control.

(4) Estimation of the errors to be expected in the procedure advocated.

It is shown that the basis of such surveys lies in the ability to fly an aeroplane on a straight course at a uniform height and speed. The knowledge and training required for this and the accuracy with which it can be done are very fully investigated. Two methods of procedure are then suggested. The first, adapted to a control of points about 10 miles apart, consists in the construction of mosaics of parallel overlapping strips of vertical photographs. The " 50 per cent. error " in such a survey is estimated at 0·03 mile and the maximum error at 0·07 mile, provided local changes of height of ground do not exceed 5 per cent. of the height of the aeroplane. The method is admittedly applicable only to comparatively flat country.

The second method is of much wider application and of more general interest. It envisages a series of straight parallel flights of 50 to 100 miles in length, arranged, in the first instance, in the form of a square or a rectangular grid. At the intersections of these strips—the corners of the grid—are placed the control points which might be fixed astronomically by surveyors conveyed thither by aeroplane. The squares are then filled in with further straight flights at about 10 miles' interval, and the whole series of strips adjusted to the control by a mechanical method which is both ingenious and simple. In this system the vertical photographs forming the strips are supplemented by obliques, taken simultaneously with the verticals, in cameras pointed to each side of the machine and rigidly fixed to the central camera at an angle just sufficient to include the horizon. From these obliques the area not included in the strips is filled in.

The method can be applied either to flat or to mountainous country, though it is possible that in the latter it would be more laborious and perhaps less precise than the authors expect. It is to be regretted that it has not been tried out as thoroughly as the straightforward mosaic method. In unmapped regions it must frequently happen that the contours and ground forms are the most important features, and it is just in this respect that the comparison of aerial with other methods appears to be least favourable to the former. It is moreover in this respect also that other writers and investigators of aerial methods have been least precise, and practical experience is lacking.

Apart from this criticism the book fills most adequately a distinct gap in the literature of aerial survey and should prove a mine of information to all those interested in small and medium-scale surveys of semi-reconnaissance type. M. N. M.

Practical Astronomy : A Textbook for Engineering Schools and a Manual of Field Methods.— George L. Hosmer. 3rd Edition. New York : John Wiley & Sons, Inc. ; London : Chapman & Hall, Ltd. 1925. Pp. xii. + 270. 13*s.* 6*d. net.*

The author is Associate Professor of Geodesy in the Massachusetts Institute of Technology, and writes with the lucidity appropriate to a teacher in that renowned school of engineering. His book is well arranged, carefully illustrated, and there are continual references to Special Publications of the Coast and Geodetic Survey in which the student may find fuller details and auxiliary tables. This third edition was required by the change of time in the Nautical Almanacs from 1925 onwards, whereby the astronomical day is made to begin with the civil day at midnight—a change carefully prepared after full discussion, but not unanimously approved.

The book is interesting to British students of Survey because in its essentials it is so curiously old-fashioned. The word " Theodolite " is not to be found in it ; but we learn that the principal field instrument is the " Engineer's Transit," which has no micrometers, has sometimes or often no complete vertical circle, generally only a single vernier on this circle or arc, and the principal bubble along the telescope ; in fact, an instrument thoroughly out of date, and most unsuited to field astronomy. We have always understood that the term " transit " in this sense dates from the time when the surveyor's theodolite was first made reversible. When the telescope was proportioned to pass through the frame, it was said to " transit," and so the absurd name came into the catalogues of the less scientific makers, and thus into common use many years ago. It was a bad misleading name, because of the inevitable confusion with the transit instrument of astronomers, whose purpose is very different. We

are surprised to find that the old British confusion of name has become in the United States a confusion of function. Prof. Hosmer teaches that "The most direct and simple means of determining time is by observing transits of stars across the meridian. . . . The transit (*i.e.* the Engineer's transit or primitive theodolite) should be set up and the vertical cross hair sighted on a meridian mark previously established." This is rank heresy. The surveyor who takes the field with an instrument that cannot measure accurate altitudes and tries to find his local time by determining an azimuth, setting out a meridian mark, and adjusting his engineer's transit upon it to serve as a transit instrument, is in a poor way.

The chapter on determining azimuth suffers from limitations due to the same deficiency of instrument. What we should reckon the standard method by altitudes of east-to-west stars, quickly applicable at any time, is relegated to the end, and the method of circumpolars at greatest elongation, limited to middle latitudes and time consuming, is given first place.

We regret, therefore, that we cannot wholly recommend to field astronomers a book which is in some respects admirable. A. R. H.

HISTORICAL GEOGRAPHY

The Geographical Conceptions of Columbus: a Critical Consideration of Four Problems.— George E. Nunn. (American Geogr. Society, Research Series, No. 14.) New York. 1924. $8\frac{1}{4} \times 5\frac{1}{4}$, pp. 148. *Maps.* $4.

Here we have yet another attempt to settle some of the questions still under dispute in connection with the voyages of Columbus, and it may be said at once that the author's conclusions seem in the main acceptable. He has no novel theories to put forward, but the value of the studies lies rather in the careful sifting of the evidence for and against the views of previous writers, and the selection of such conclusions as seem to bear the test of critical examination. Although Mr. Nunn appears to have approached the subject without bias, the general result is to restore to favour some at least of the older views of the aims and achievements of the navigator as against the somewhat revolutionary ideas of writers like Vignaud.

The first of the four studies is concerned with the basal question of Columbus' reduced estimate of the length of a degree, on which the feasibility of reaching the east by the west so largely turned. Writers most prejudiced in his favour have hesitated to accept the navigator's claim to have verified that length by actual observations. Mr. Nunn holds that, interpreted in due relation to the methods then available, the claim must not be so summarily rejected. The test would consist merely in comparing the distance in degrees between (say) Lisbon and a point on the Guinea Coast of which the latitude was thought to be known (it could have been checked by Columbus himself during his voyages to that coast) with the distance obtained by dead reckoning. Since even the best maps placed the Guinea Coast as a whole much too near the equator, the interval in degrees would be in excess, and the length of the degree proportionally too small. Thus the cosmographical arguments of Columbus are held to have been not so entirely devoid of foundation as Vignaud thought them. The second study tends in a similar direction. That scientific considerations did underlie the plans of Columbus is held to be proved by the routes actually sailed in 1492 on both the outward and return voyage, which show the navigator to have been well versed in the winds and currents of the Atlantic. But this is after all rather a question of practical seamanship, the possession of which few would deny to Columbus; moreover, the part which

may have been played by Pinzon in the first voyage is left out of consideration.

The third study is devoted to the question whether Columbus in his last years really believed he had reached the shores of Asia, and Mr. Nunn's arguments in support of a reply in the affirmative seem unanswerable. (Here he is opposed to the views, not of Vignaud, but of Harrisse and Thacher.) He shows that, given the ideas as to the position and configuration of Eastern Asia then prevailing, it was not only an admissible but almost a necessary conclusion on the part of Columbus that when exploring the coasts of Cuba and "Veragua" (Honduras) he was tracing those of Mangi (S. China) and Ciamba (part of Indo-China). There is certainly a striking agreement in the trend of the coasts explored with the supposed outlines of Asia in the latitudes in question, the chief difficulty being to harmonize the distances covered with the far greater ones needed to bring the navigators even to the position then assigned to Eastern Asia. Such over-estimate of distance is hardly consistent with Mr. Nunn's conclusion in the first study that fairly accurate results were obtained by dead-reckoning.* Still the rough map of Bartholomew Columbus shows that such an over-estimate was actually made.

The fourth study deals with a closely connected subject—the meaning of the enigmatical coast shown west of Cuba in maps like the Cantino—for the solution of this riddle has an important bearing on the conceptions of Columbus as to the coasts he explored. Here again Mr. Nunn takes a sensible view and declines to believe, as some have done, that the land in question stands for Florida. The absence of all record of a discovery of Florida so early as 1502, the omission of any other representation of Cuba by Ruysch, and the actual labelling of this land as Cuba by Waldseemüller, are in themselves pretty strong evidence; but Mr. Nunn gives further proof that Cuba is intended by showing that not only in its shape, but in many of the names inserted, there is a striking agreement with the records of Columbus' voyages on the Cuban coasts. The failure of Harrisse to find such agreement was due to his having listed the names in one direction in one case, in the opposite direction in the other! † It would have been easy also to refute Harrisse's argument from the simultaneous appearance of Cuba in its proper place in some of the maps by pointing to numberless instances of reduplication in the old maps—notably of Java in those of the East Indies.

The volume is well illustrated by reproductions of old maps besides a useful comparative view of the discoveries of Columbus in relation to the geographical conceptions current in his time, and to the facts as now known.

E. H.

Atlantis in America.— Lewis Spence. London: Ernest Benn, Ltd. 1925. 9 × 5½, pp. 214. *Illustrations.* 10*s.* 6*d. net.*

Dr. Jowett of Balliol is credited with saying that no one knew better than Plato how to invent a splendid lie. This same Greek philosopher it was who fathered on the world the Atlantis legend after it had been bandied from mouth to mouth for, it is said, many prehistoric millennia. One is rather surprised to find the truth of the myth still advocated. Mr. Lewis Spence, the author of the volume under notice, believes, however, that after all "Plato's text

* To think that latitude observation might check the dead-reckoning on a north-to-south course pre-supposes a knowledge of the length of the degree, and is therefore inadmissible when the question is the determination of such length.

† Many years ago the present reviewer made a similar attempt to harmonize the two sets of data, but failed to reach the positive results now put forward by Mr. Nunn.

furnishes a reasonable case in favour of its authenticity." This book is a sequel to his previous 'Problem of Atlantis' (*Journal*, 64, p. 181), in which an attempt was made to prove the real existence of such a now submerged continent. The author's aim in the present work is to press acceptance of his belief that civilization, conceived by him to have originated in the undivided Atlantis, inhabited by the Cro-magnon race, passed westward *via* Antillia —the disrupted portion of Atlantis—and, "through its territorial and cultural connections" before dismemberment, contributed the Maya culture to Central America—a theory to which no Americanist of authority, notwithstanding Mr. Spence's claim to their countenance, has subscribed. As supporting his deductions the author claims that "the myths and traditions of America preserve a very definite memory of Atlantis and of the great upheavals which culminated in its destruction"; that a chain of associated customs with one missing oceanic link stretches from Egypt to America; and that "Atlantean tradition appears to provide the missing connection." He devotes many pages, we think ineffectually, to evidence from, besides others, faunistic distribution, the practice of mummification, a cult of female sorcerers in America, and from "the analogy of the similar continent of Lemuria in the Pacific." *En parenthèse*, Lemuria has hitherto been applied to a land mass connecting South Africa through Madagascar with Peninsular India: this confusion of the Pacific with the Indian Ocean is due, we suspect, to maps and arguments given to the world "by means of astral clairvoyance" through Mr. W. Scott-Elliot, and to Prof. Macmillan Brown's 'Riddle of the Pacific' (cf. *Journal*, 65, p. 525), from which Mr. Spence quotes the insufficiently documented instances of vast subsidences in the Pacific, as giving high probability for those in the Atlantic.

There is abundant reason to believe that larger or smaller land masses have occupied what is now the Atlantic basin at different periods. Wegener's hypothesis is that the coasts of eastern America and Eurafrica were once in actual contact and then glided apart about the close of the Jurassic, leaving a clear and widening Atlantic. Several well-known French geologists, however, (*Journal*, 41, p. 391; 63, p. 85) support the view that after an ancient land mass occupying the North Atlantic had sunk, a southern, the "Atlantide," separated from it by the "Eocene Sea," began, during the Miocene and the beginning of the Pliocene, to crumble to its doom. Other equally distinguished geological authorities—Neumayer, Lyell, Koszmat, Wyville Thomson, Suess—consider that the Atlantic existed, more or less as we know it, from about the end of the Cretaceous. The maps in the 'Cambridge Ancient History,' indicating the growth of land masses, depict an Atlantic Ocean from the Arctic to the Antarctic (narrower in some regions of its latitude), from the Upper Cretaceous till the Pliocene. Prof. Boyd Dawkins looks upon the "modern" view of Atlantis as absolute fiction. None of the authorities above referred to have suggested that any of these land masses were in existence in the human period. The earliest evidences of man on the globe do not antedate the topmost Pliocene, and his appearance even there is doubtful. Long before the Pleistocene began there survived only a mere string of chips dislodged from the eastern margins of the Atlantic, so no continent could have been in place on which the Aurignacians or any other folk might originate civilizations and legends for distribution to either Europe or America. When the existence of "Atlantis" in the human period has been proved, it will only then be time to consider the arguments set forth in this book for the origin of the Maya civilization.

H. O. F.

GENERAL

Practical Hints to Scientific Travellers.— Edited by **Prof. H. A. Brouwer.** II. Leyden: E. J. Brill, Ltd. 1924. 9½ × 6½, pp. 102. *Illustrations.*

Several authors have contributed to this volume, which forms the continuation of a previous instalment noticed in vol. **64**, p. 73. An admirable summary of conditions of life in Arctic regions by Dr. W. Werenskjold is followed by chapters of practical hints by Dr. A. Hoel on Spitsbergen, Dr. O. Holtedahl on Novaya Zemlya, Dr. O. B. Böggild on Greenland, and Dr. D. Mushketov on Turkestan, a chapter which is a little out of keeping with the others. Dr. Werenskjold has some references to Antarctic conditions, but they are inadequate and of little value. This however matters little and does not detract from the value of the book, since the amateur explorer and summer traveller, to whom the pages are addressed, does not visit south polar regions. It would, however, have been well to refer to other volumes than Amundsen's for details of outfit and provisions in the south. The use of English for all the papers indicates that the writers intend the book to appeal to a wide circle of readers. It is therefore surprising to find few references except to Scandinavian books. Dr. Hoel's brief list of books is quite inadequate and a poor guide even to writings on Spitsbergen. Furthermore, it is not apparent why the Danish station at Disko should not find mention by him when he notes the Norwegian station at Mygbukten in East Greenland which has ceased to exist. But except for these criticisms the volume merits praise. It is written by men who have had wide experience of the respective Arctic lands and should prove a safe guide to any intending traveller. Moreover it covers ground which is inadequately treated in other volumes of a like nature. The reviewer put the chapters, especially that on Spitsbergen, to a severe test, for he has not only examined them in the light of experience but has subjected them to searching criticism in camp and boat in polar regions. The outcome is a few minor suggestions, rather involving personal tastes than implying reasoned opposition. The list of supplies in Dr. Hoel's list is based too largely on Norwegian taste: a British expedition would be wise to modify it by the exclusion of such unsavoury tinned productions as fish meal, fish cakes, and milk powder. But in other respects the estimates for an expedition are a valuable guide: they omit nothing from a boat to a tin-opener, and give the cost and weight of each item. The illustrations are chosen with care. R. N. R. B.

Military Geography of the British Commonwealth.— **Major A. E. W. Salt.** Aldershot: Gale & Polden. 1925. 8½ × 5½. Pp. xvi. + 401. 10*s. net.*

This is the third military geography received for review within six months; the author is, again, an officer of the Army Educational Corps; and the book repeats the failings of its predecessors. Except for a lonely equator that has crept into one map, there is not from end to end a single contour, a single parallel, a single meridian—not even long. 110° E. being shown on a map labelled "Singapore in relation to the Pacific." But the book has this in its favour, that the treatment of its modicum of geography is at least rational, and that there is frank and generous acknowledgment of debt to Dr. Vaughan Cornish. It is a great pity that, when the author has such a high appreciation of Dr. Cornish, he did not copy his really geographical methods.

The book is clear and sensible, even if it wanders far outside its nominal limits; but its geography is so elementary that, especially when one compares it with a French military geography, one can only express again the strong opinion that the Army Educational Corps does not know what geography

really is. And this opinion is confirmed by the Foreword from Lieut.-General Sir C. H. Harrington, in which he says that this book by his "Senior Education Officer will be of immense assistance to those who wish to study the *history* of the British Commonwealth." That may be true; but, in that case, why call it a 'Military *Geography*'?

In a book of over 400 pages, travelling over the New Europe and the Near East, etc., there surely might have been an index. L. W. L.

Allgemeine Wirtschafts- und Verkehrsgeographie.— Karl Sapper. Verlag und Druck von B. G. Teubner. Leipzig; Berlin. 1925. 9¼ × 6, pp. 300. *Seventy Map-diagrams and Statistical Tables.*

The writer of this work is to be congratulated on the skill with which he has handled what would, without his guidance, have seemed merely vast and inchoate masses of material, and also for the patient certainty with which, in spite of the tenuity of the connecting threads, he has succeeded in binding the facts together to form a convincing and harmonious whole. The book, if rightly used, should prove a gold-mine to the student, and, no matter what the special interests of the reader may be, none will be turned empty away. The main theme is always elaborated with care, but, lest details should cause the energy to flag, the pages are enlivened with quaint half-humorous touches which, even if trivial in themselves, serve to assist the memory and keep thought alive.

Where so much is good, it is difficult to select any particular features for special mention; one cannot, however, help admiring the clear and concise manner in which man's dealings with the forces of nature are described, showing that not even the most insignificant or incidental of these has escaped attention. The interdependency of man and his environment is well kept in sight throughout, and a distinction is drawn between what must and must not be considered as commercial factors; thus, whereas elevation is important as a potential source of power, extreme elevation is, in this connection, an altogether negligible factor. The relationship between man and rainfall is suggestively described, and the direct influence of contour and slope on human occupation is not forgotten. The climatic zones, which seem to be established on the Supan basis of using the isothermal lines as boundaries, are not very clearly defined, and the text does not make use of the diagram on p. 28.

The mention of Bergeat's theory as to the possibility of establishing petrographical provinces seems to open up new fields of inquiry, and many other important points of general interest are touched on, as for instance the fact that, although mineral wealth is evanescent, yet an industry once established on that basis may continue to flourish long after local supplies are exhausted.

In dealing with the difficult question of the races of mankind, the older and more spectacular colour classification is used. This makes for simplicity, but mention might have been made of more modern and exact methods.

The careful and painstaking attempt to systematize the various cultures is helpful and illuminating. The use made of the term "Germanic" seems, however, to imply the supremacy of a purely local *i.e.* German element, whereas actually the so-called Anglo-Saxon is the predominating constituent of this culture, and owes its versatility to the fact that it has to a large extent a mixed race-origin.

In dealing with the early culture-stages and their transitions, the writer uses a somewhat new method of classification which certainly has points to commend it. Instead of separating mankind at once into pastoral and agricultural groups, he looks upon the former as a specialized side-shoot of

the latter, owing to the dependence of the shepherd upon the agriculturist, and differentiates between the cultures according to the instrument used. He does not refer to Morgan's "transitional ideas," such as discovery of fire, invention of pottery, etc., which may, by enlarging the outlook, have facilitated the passage from one culture to another.

In the last section of the book every form of transport and intercommunication is considered. The part on railways is lacking in illustrations, and it might be suggested that the length of the railway net is of little account as compared with the weight carried. The historical account of the waterways is complete and satisfying.

If only the illustrations had been worthy of the text, no student of commercial geography could have afforded to be without the book; this is unfortunately not the case. The maps, towards the end especially, are as destructive to the eyesight as they are clogging to the memory. Nothing is gained by such overcrowding, for the multiplicity of signs and symbols used produces an effect merely of confusion and vagueness. The reader would have been helped if, throughout a series of maps, the same sign had been used for one thing. This has not been done, even when, as on pp. 208 and 209, a comparison is made.

The bibliography at the end of the work is a valuable feature, but would have been far more so if the main authorities on each subject had been quoted, irrespective of nationality, the minor ones being omitted, and if the numbers had been consecutive throughout. E. G. W.

THE MONTHLY RECORD

EUROPE

Emigration from Southern Italy.

A DETAILED study, with many statistical tables, of the causes and effects of Calabrian emigration is contributed by Prof. Paride de Bella to the *Bollettino della R. Società Geografica Italiana*, Nov.–Dec. 1924. The population of Calabria in 1911 was 1,402,151, an increase of 30,000 during the previous ten years. During the same period the number of emigrants was 434,760. Just before the war the annual total of emigrants was beginning to decrease, but in 1913 it was still as high as 55,910. Though earthquakes and similar calamities have contributed, the main factor in this falling off of the growth of population has been this heavy emigration. The figures for the circondarii show that the smallest increase in population is coincident with the heaviest emigration rate. The majority of the emigrants, about 80 per cent., are males; as a result, though there are fewer female births, the women outnumber the men at home. Those going abroad as a rule are chiefly agriculturists, coming from the more mountainous, rural, and malarial districts. Emigrants went at first in small numbers to Egypt, Algiers, and Austro-Hungary, but the main field has been the two Americas, whither 90 to 95 per cent. of them go. A considerable number went to Brazil, until deterred by the yellow fever, and to the Argentine. Latterly, however, roughly two-thirds of them have gone to the United States. There they are absorbed chiefly into the cities, and become Americanized after one generation. On this account the writer would like to see emigration to the Argentine encouraged, as immigrants seem to preserve their national characteristics better there.

The causes of this movement are varied and deep-seated. The effect of malaria and earthquakes is plain. There is said to be a certain political antagonism between the north and south of Italy since the Union, the latter feeling that it has not reaped its full share of the benefits. The railways in the south, for instance, have not been developed as fully as might be. Then local industries, such as the silk manufacture, are almost entirely rural and primitive. Hydro-electric power has not been as fully developed as in the north. The mainstay of the region is agriculture: here the holdings are said to be un-economic, and the methods antiquated. Housing, sanitation and roads are also poor. The writer also speaks of the backwardness of the people through the low state of education. The root of the matter is the lack of capital: in spite of supplies originating in emigrant circles, the financial wealth of the area is small. As remedies for this condition of affairs, the writer urges the introduction of capital from the north; more active governmental interest; further anti-malarial measures; industrial co-operation; and the reform of local administration and education. Meanwhile, till these take effect, the lot of the emigrant might be improved, communities of settlers organized overseas, and further spheres of colonization secured.

ASIA

Extension of the Ceylon Government Railway.

We have received from Mr. G. S. S. Gordon, M.C., some notes upon the extension of the Ceylon Government Railway to Trincomali and Batticaloa. The objects, among others, were to open up fresh areas for paddy-growing, to improve transport facilities for the export of timber, and to develop Trincomali as an export and import centre for Southern India. The line is a "light" railway, and its route has been largely determined by the necessity of avoiding tunnels. It leaves the existing northern line at Maho and runs through Habarane to Trincomali, the branch line to Batticaloa striking off at Habarane. This indirect route was selected in order to open up a larger area of country. A coast route from Trincomali to Batticaloa would also have entailed building many more bridges. The total length of the line is 181¼ miles. The only towns of size along the line are Trincomali and Batticaloa, the remaining places being small villages of from fifty to five hundred inhabitants, though some of the agricultural districts are fairly thickly populated. A future extension of the line across the Kalladi estuary at Batticaloa to Kalmunai would tap a large coconut and rice-growing district.

The survey of the line occupied about a year; it was somewhat hampered by the lack of a detailed topographical map and the denseness of the jungle. It was decided to lay the rails "over end" from Maho alone, as locomotives and rolling stock were limited, and it would have been difficult to land them at Trincomali or Batticaloa. The work was begun in 1921. The engineering difficulties were not great. The country, however, was malarial, especially during the wet season, and coolies consequently difficult to obtain. In the dry season shortage of water held up the work. The supply of skilled fellers and sawyers for cutting sleepers and masons for bridging was also difficult to maintain, the Ceylon coolie associating the breaking of metal by hand with the usual occupation of convicts. As a result the labour force did not exceed seven thousand men, and was often very much less. The whole system should however be finished by the end of this year. With the tackling of the malaria problem, further areas could be brought under cultivation, and rice, paddy, coconuts, and tobacco grown. A number of useful timber trees are also obtain-

able, for which a limited demand exists in the island. Trincomali has a fine natural harbour, and with the development of commercial relations with the rest of the island and Southern India should become an important port.

Water Transport of Timber in Burma.

We have received from Major R. S. Wickham an interesting account of work on the timber waterways of Burma. The Myitmaka (Hlaing) river, at the mouth of which is the city of Rangoon, flows for the greater part of its course to the east of, and parallel to, the Irrawaddy at an average distance of about 10 miles. East of the Myitmaka again are the Pegu Yoma hills. From these hills nine streams flow down to join the Myitmaka at right angles. About twenty years after the annexation of the province, the forests on these hills were made into reserves, and they are now the source of some of the finest teak in Burma. Through a local characteristic these logs can be transported very cheaply by water to Rangoon. From June to October the Myitmaka valley is flooded by the Irrawaddy, which pours in at two points. For five months the area is flooded to a depth of from 5 to 15 feet. During this period the inhabitants lead an amphibious life. The cattle are driven away to higher ground before the inundation; but pigs, chickens, and ducks, with the households, are confined to platforms and houses on stakes. Advantage is taken of this condition to float the logs down the streams to the "laha," or flooded area. To achieve this, the streams have to be carefully watched and tended. When floods occur in the hills, great quantities of the sandstone are eroded and deposited at the mouths of the streams. If the stream is allowed to find its own way through the delta, the logs may be spread over a wide area, becoming lost or buried. If possible, jams are released by moving the key logs at their heads. Large jams generally have to be left until the stream falls slightly, when a new channel is dug through the delta, and the logs floated through, those in rear first of all. A frequent cause of jamming is the water hyacinth. This plant floats down the Myitmaka, blocks up the mouths of the tributaries, and binds logs and rafts together. Many methods of dealing with this pest have been tried, but none has proved entirely successful. The main timber depôts of the Forestry Department are in villages along the river about 12 miles apart, from which the work of receiving, classifying, and despatching the logs in rafts down to Rangoon is supervised. The silt brought down by the streams and deposited below the annual flood-level is very rich. In some years as much as 8 inches is deposited. By careful regulation of the streams about 10,000 acres of land have been brought under cultivation during the last nine years. Part of the "laha" is still forest: characteristic trees of this fresh-water swamp are *Mangifera longipes* and *Anogeissus acuminata*. The first, however, is gradually decreasing.

AFRICA

The Shire Valley, Nyasaland.

A recent publication of the Geological Survey Department of the Nyasaland Protectorate contains an analysis of the physiography, economics and transport routes of the Shire valley by Dr. F. Dixey. The valley is part of the Great Rift Valley of East Africa: leaving the south-eastern arm of Lake Nyasa the main valley runs approximately south-south-west to the Murchison Falls, and then strikes south-south-east towards Port Herald. The area has experienced several distinct periods of faulting. Fault lines may be traced parallel to the Upper Shire valley, from Lake Chilwa to the western slopes of the Malanje Mountains, and others parallel to the Lower Shire valley,

running from Lake Nyasa to the eastern slopes of the Malanje. Consequently the Shire Highlands may be regarded as a diamond-shaped upland area formed by these rifts. At their points of intersection are Lakes Malombe and Chilwa. The walls of the Shire valley are generally bold and well defined. Gaps occur, particularly for 20 miles of the eastern wall south-west of Lake Malombe. On the western side there is an important gap south of the Kirk Mountains. The varied nature of the valley floor bears witness to the numerous stages of development through which it has passed (earthquakes are still not infrequent). It is a broad faulted valley-plain, overlain by much alluvium and gravel, with older rocky fault-blocks and marginal platforms. Evidences of erosion, particularly at Patamanga, where the river has cut through a 600-feet crystalline ridge, show that the river was formerly much stronger. Some of the Shire's larger tributaries have been affected by the faulting: they flow in fault angles parallel to the main course, and, on emerging from them on to relatively open plain, are influenced by the eastward slope and join the Shire at a moderate angle. The remainder of the tributaries join the main river at right angles.

The soils of the region can be divided into two groups. In the modern alluvial areas it is light and fertile; water can also be reached at slight depths, except on the higher terraces. These are good cotton-growing areas. The old valley plains and the higher levels, through frequent faulting resulting in much soil erosion, are largely composed of gravel and rock fragments. Where the soil has accumulated under protection it is of good quality and tobacco can be grown. These areas are waterless for the greater part of the year.

The Shire has ceased to be a navigable river, through the formation of natural barriers due to its low gradient, great sediment deposits from its tributaries, decrease in the number of perennial streams, and its dependence on the level of Lake Nyasa. At the end of the dry season of 1924 Lake Malombe was completely dried up. It has been reported that the re-establishment of the river would be beneficial and practicable, although the Murchison Falls and rapids prevent its use for through communication with Lake Nyasa. The railway now runs up the Shire valley to Chiromo and thence into the Highlands to Blantyre. Formerly travellers then went on to Matope and completed the journey by river. There is a practicable railway route from Blantyre to Matope, and the line could be carried up the Shire valley. There is also another practicable route up the Ruo valley, skirting the Highlands on the east, to rejoin the Shire south of Lake Malombe. There are good supplies of crystalline limestone and travertine throughout the valley, suitable for building, road metal, and other purposes. The coal deposits of the Lower Shire are being examined, and evidences of other minerals have been found.

Ancient Mines in Egypt.

Mr. H. W. Seton-Karr has asked us to publish the following note. In 1896, with the help of H. E. Johnson Pasha, he discovered some flint-mines on the plateau of the Eastern Egyptian Desert. In consequence of this he was asked by Mr. Streeter to try and find the long-deserted emerald mines in the same region. They had been worked by Caillaud about a century before, and one had been descended by M. Floyer, who was Director of Telegraphs at that time, but their position was not accurately known. Mr. Seton-Karr left Darau on the Nile in December 1897, and succeeded in finding and visiting all the Jebel Sikait and Jebel Zabara shafts. He later published the results with a map, a copy of the monograph being deposited in the Society's library. When in Cairo at the International Geographical Congress this year, Mr.

Seton-Karr's attention was drawn to the fact that Mr. McAlister, who was sent as a mining expert to the mines the following year, had published a long account in the *Geogr. Journ.*, vol. 16, 1900, in which he does not mention Mr. Seton-Karr's visit, and makes it appear that he was the first visitor since Floyer, and the practical re-discoverer of the mines. As a matter of fact, he received some assistance from Mr. Seton-Karr and used the latter's map to illustrate the paper in the *Journal*.

The Galiton Islands, Tunis.

Major W. H. Fox, H.B.M.'s Consul at Bizerta, has sent us an account, illustrated by photographs, of a visit paid to the group of islands known as Les Galitons, off the Tunisian coast, about 50 miles west of Cape Blanc. As they are seldom visited, Major Fox thinks he is probably the first Englishman to have landed there. The French Government maintain a lighthouse upon one of the islands. The largest, La Galite, about 3 miles long and 1 mile wide, is occupied by thirty Italian and Spanish families who have settled there during the last forty-five years. The island is granitic with a considerable quantity of soft volcanic material, in which shelters and caves are easily dug. In one cave eight manacled skeletons and a number of Roman coins were found. There is also a copper-mine, and granite for the French arsenal on Lake Bizerta was got from here. The inhabitants live by fishing, gardening, and keeping a few sheep and goats.

AMERICA

The Salt Lake "Oasis," Utah.

The highly organized unity of the Salt Lake "Oasis" in Utah and its underlying geographic factors are strikingly brought out by Mr. Langdon White in a profusely illustrated article contributed to *Economic Geography*, July 1925. The oasis is the long and narrow strip of country lying between the foothills of the Wasatch Mountains on the east, and Great Salt and Utah Lakes and the desert on the west. The southern and northern boundaries are less strikingly apparent but nevertheless of economic importance. The northern is determined by the gradual rise of the land preventing irrigation. The southern is a low range with north and south valleys supporting cattle. The area thus defined is about 1300 square miles, though only 680 square miles are occupied, the remainder being waterlogged. The oasis at present supports a population of approximately 390 persons per square mile, centring in Salt Lake City and Ogden. For the State of Utah the figure is (1920) 5·5 per square mile. The basis of this community is essentially the water-supply from the streams flowing down the western scarp of the Wasatch Mountains. The average precipitation is from 12 to 20 inches, increasing steadily from west to east, and mainly falling in winter and spring. The forested upper slopes of the Wasatch retard the melting of the heavy snow precipitation and prevent spring floods. This distribution, coupled with the hot dry summers, particularly favours the growing of wheat. The region is part of the area once occupied by Lake Bonneville; geologically therefore it consists of flat, unconsolidated, lacustrine sediments, rich in phosphorus and potash. The possibilities of this region were first perceived and developed by the Mormon leaders. From 1847 to 1869 the settlements were purely agricultural, the inhabitants cultivating the well-drained middle valley belt, and living in towns and villages with a view to security from Indian attack. From the first the Mormon ideal was self-sufficiency, so that many rural industries were started. A great change was wrought by the building of the Union Pacific transcon-

tinental line in 1869, from which date Ogden steadily grew into a great railway centre. Though industrial development has been rapid, agriculture still predominates. The chief crops are sugar beet (16 per cent. of the cropped land), alfalfa (over 25 per cent. of cropped land), and wheat (approx. 30 per cent.). The remainder is devoted to fruit trees and vegetables. The average "intensive" holding of irrigated land is from 5 to 20 acres. The tendency now is to exclude wheat from such holdings, and to raise it by dry-farming. Much cattle is raised on the poorer lands: for every 100 acres under crops there are 136 acres under pasture. Cattle and sheep are also kept in the forest areas, and brought down and fed on by-products during the winter. Though the "oasis" does not produce a large proportion of Utah's wheat, most of the State's fruit and vegetables are grown there. Besides being necessary for the supply of local requirements, factories have grown up to turn the produce into forms suitable for export over long distances. Flour milling, sugar refining, fruit and vegetable canning, and meat packing are all carried on. Power is cheap, communications good, labour plentiful (the small intensive holdings cannot support the large Mormon families), and minerals are at hand, so that 80 per cent. of the industry of Utah is concentrated in the oasis. Large quantities of salt are obtained from the lakes. There are large lead, silver and copper furnaces. The latter is almost wholly obtained from Bingham canyon and smelted at Garfield. In 1924, 125,000 tons of copper bullion were produced. Of the lead and silver ore, 70 per cent. is from the neighbourhood, the remainder coming from as far afield as British Columbia. The comparative isolation of the oasis from the great centres, and the preferential railway rates given to the Pacific coast areas, are the main obstacle to its further advance. A somewhat parallel example of intensive development under similar circumstances, *i.e.* the Californian raisin industry, was described in the *Journal*, vol. 65, p. 181.

Laguna Colorada, Puna de Atacama.

A journey into the desert of Southern Bolivia, in the area known as the Puna de Atacama, is described by Mr. F. C. Walcott in the *Geographical Review*, July 1925. Mr. Walcott was led thither by the reported discovery of a lake of brick-red water in the centre. At the beginning of 1924 he made his way by motor and rail from Chuquicamata, Chile, to San Pedro, and on by mule train through Siloli, on the international boundary. The lake, the Laguna Colorada, lies in the basin between the mighty Western Cordillera of the Andes, and the chaotic eastern ranges. The area is predominantly volcanic, some of the younger cones being still active. In the middle of the 50-miles-wide basin there are the remains of an older range of rhyolite, weathered into strange shapes. The pack train entered the basin over the 15,000-feet divide, experiencing heavy snow and hail storms. Signs of life were very meagre, and springs few. Mr. Walcott was only able to stay three days at the lake. It is about 10 miles long by 5 miles wide. The red colour of the water is due to minute crustaceans, upon which thousands of flamingoes feed. Except for these flamingoes, which were of the rare *Phœnicoparrus andinus* variety, and whose number was estimated at 20,000, life was rare. Traces of rhea and vicuña were seen, also crested duck and ground doves. The Indians from the villages on the mountain slopes have developed a regular traffic in the flamingo eggs: all the season's eggs are baked and sent down for food. It would seem, therefore, that these birds are doomed.

On his return journey Mr. Walcott visited two Indian settlements—Toconce and Aiquina. He found traces of Inca influence there, and the buildings reminded him of the pueblo villages of New Mexico. The Indians depend

chiefly upon their flocks and herds, and grow some alfalfa, maize, and wheat. Most of these villages on the upper slopes of the Western Cordillera occupy *cul-de-sacs;* San Pedro de Atacama, the most flourishing, owes its importance to its position on a line of communication with the North-West Argentine. The resources of this portion of the Andes are limited to mineral ores, nitrates, and other salts. Its desert character is largely due to the cold Humboldt current which sweeps the coast. Mr. Walcott adds a note on one of the periodic lapses of this regimen, when it is replaced by a warm, south-flowing current, the El Niño. During its occurrence in March 1925 there were high irregular water temperatures along the coast, ranging from 65° to 80°, as compared with a range of 56° to 68° in February 1921. The air temperature was tropical, and gales, thunder and lightning, and heavy rains were experienced. Many of the mud houses, not built to stand rain, collapsed, roads and railways were washed away, and plagues of flies appeared. The whole coast, usually parched, began to assume a green covering.

POLAR REGIONS

Norwegian Research in Spitsbergen and Bear Island.

Through the courtesy of the Foreign Office we have received the translation of an article in the *Aftenposten*, of Oslo, describing the principal results of the Norwegian expedition to Spitsbergen and Bear Island carried out during the past summer under the leadership of Dr. Hoel, whose previous labours in the same field have added so largely to our knowledge. In Spitsbergen the sphere of operations lay in the south central part of the West Island, between Van Mijen Bay and Ice fiord, and four parties took the field with a view to completing the survey of the eastern part of the coal-bearing tract in this region. As the country is covered with ice and snow transport was a matter of difficulty, the parties being equipped for the whole summer and each having kit weighing some 1000 kilograms; depôts laid out by the Store Norske Company were however of considerable help. Two of the parties set out from Sassendal, and two from Braganza Bay, and they met halfway. They were fortunate enough to effect a connection with the Russian survey points on Stor fiord. Dr. Hoel, Dr. Braastad, and Mr. Orwin carried out geological work slightly further west, and the last-named made the interesting discovery of the skeleton of a giant lizard of Jurassic age, found partly embedded in shale. No such complete remains had ever before been found in Spitsbergen. In the absence of suitable implements for digging out the remains, it was necessary to leave them till another occasion. On the peaks at Van Mijen Bay Dr. Braastad examined remains of fossil trees of Tertiary age. There were large trunks and smaller pieces not so well preserved, and it seemed as if regular lumbering had been carried on. Although the expedition worked in what are considered the best reindeer districts in the country, only eight or ten animals were seen, so that the stocks must have greatly diminished, and there is urgent need of protection. Work was also done on Bear Island by Messrs. Horn and Marstrander, who, besides boring for coal, investigated occurrences of galena in the south-east of the island. It has been proved that mixed seams of sulphate of barytes and galena occur, and that there is one pure seam of galena 30 to 40 centimetres thick, so that the prospects of working it with success are thought to be good. At sea, Capt. Hermansen and other officers of the *Farm* carried out soundings and other oceanographical observations. The inner part of Ice fiord was sounded, and data collected for completing the chart of the waters between South Cape and Cross Bay on the scale of 1/100,000. Tem-

perature observations gave the remarkable result that at nearly all depths the water was warmer than in 1924 by 2 to 3 degrees, even though the temperature was very high last year. The air temperature was also high, and whereas winter minima of −48° to −50° were formerly recorded, last winter the lowest was scarcely −30°. It was mild also during the summer, and the glaciers are rapidly diminishing both in length and thickness, so that mountain ridges emerge. If this process continues, winter migration of birds will be a thing of the past. Lastly, information is given as to the present position of the coal industry. The Norwegian company continues to work full time, while the Dutch are at present contenting themselves with the erection of works. Much time has been lost by the Swedes owing to a fire in their mine, now extinguished. The Anglo-Russian Company is continuing its operations, and gets good prices on the Murman Coast. The general position is difficult, however, owing to the fall of prices, but it is thought that coal as good and cheap as the English can be produced, and that the depression may not last. In 1925 the total exports were between 400,000 and 500,000 tons.

GENERAL

Variations in Rainfall and their Bearing on Tropical Development.

The character of tropical rainfall is discussed, with a series of tables, by Mr. S. S. Visher in the *Geographical Review*, July 1925. His aim is to dispel misconceptions of the productivity of tropical countries based upon the assumption that the heavy rainfall is regular and well distributed. The regional distribution in the tropics is exceedingly variable—from 400 inches to almost none in arid regions—while in rugged areas where the relief is not more than a few hundred feet the local distribution also varies considerably. In the Hawaiian Islands the precipitation in places of equal variation only a few miles apart, ranges from 25 inches to 90 inches. Seasonal variation is also pronounced. On the whole there are distinct wet and dry seasons, and in some areas two wet and two dry seasons. A case of exceptional variation is Harvey Creek, Queensland, with a rainfall of 165 inches, of which only 15 per cent. falls from June to October. Mr. Visher has calculated that in low latitudes (30° N. to 30° S.) the area possessing a monthly variability of more than 20 per cent. is three times the similar area in middle latitudes (30° to 60°), and twice as large a percentage of the low latitude area has this range. He has also worked out figures for the extreme annual range of rainfall for a number of cities in mid and low latitudes. For seven out of the twenty-three cities in the first class the precipitation for the wettest year was less than twice that of the driest, and for eight it was just over twice. Four cities, mainly marginally situated, Hobart, Buenos Aires, Rome, and San Francisco, received four times as much. In the low latitudes, out of fourteen cities with an average rainfall of 30 inches or more, two alone, Calcutta and Caracas, show a maximum $2\frac{1}{4}$ times as great as the minimum, while at the other end of the scale Fortaleza has one six times as great. If the average rainfall of 20 inches is taken, the fluctuation is even greater, varying from $6\frac{1}{2}$ times for Cairo to 47 times for Onslow, West Australia. Heavy rainstorms, rapid run-off, and great evaporation, added to the variation dealt with above, handicap the development of many tropical regions, and local conditions require careful study before their resources can be utilized. Mr. Visher proposes to make a special study of rainfall conditions in tropical America.

Portolan Charts as an Aid to History.

Although the relative accuracy of the Portolan charts has long been recognized, it is a question still undecided how far their unsupported testimony can be held to justify conclusions on doubtful points of history (cf. Mr. R. D. Oldham's paper on the Rhone Delta, *Journal*, vol. 65, pp. 403 *et seq.*). In a paper read last year before the Royal Society of Antiquaries of Ireland and since printed in the *Journal* of that body (1925, pp. 31–35), Mr. M. C. Andrews points to a feature of certain Venetian charts of the fifteenth century, which to his mind proves that the north coast of Ireland was well known to Venetian mariners of that time. He refers to the surprisingly accurate delineation of Rathlin island in a chart of Jacobus de Giroldis (1422), to be found also in two other Venetian charts of about the same period, one by Franciscus de Cesanis, the other anonymous. No equally correct representation is to be seen in any other of the 350 marine maps of Ireland of which Mr. Andrews possesses photographs, although in two others the representation appears to be derived from a similar source, but to have become debased in course of time. It is a curious fact, tending however to prove that some relationship exists between the charts in which the more or less correct form is given, that in all of these the initial R of the name of the island (spelled besides in various ways) is dropped out, whereas in all the charts which do not exhibit special knowledge it is retained. Apparently nothing is known of Venetian voyages to Northern Ireland in the fifteenth century, and the reason for such is not apparent. It would seem possible that the correct drawing might be due to some chance item of information that reached Venice in those days, rather than to a continuous series of voyages; but the point is an interesting one, and it is well that the attention of students should have been directed to it.

Wall Map of the British Empire.

By authority of the Navy League, and in conjunction with it, Messrs. G. Philip & Son have recently produced and published a large coloured wall map of the world (80 by 60 inches) called the Navy League Map of the British Empire. It is attractive in appearance and contains some interesting and novel features which should make it of considerable value in schools; indeed, all desirous of readily obtaining general information about the different parts of the Empire will find it useful. By red layer tinting Great Britain, the self-governing dominions, and India, are prominently shown, and by lighter tints and bands of the same colour, it is easy to distinguish British Protectorates and Mandated territories. Various other colours show the territorial possessions of other colonizing powers. By different symbols the principal sea-trade routes, naval dockyards, oiling stations and oilfields, coaling stations, wireless stations, through railways, cables, and other details of economic importance are shown; while a set of graphic diagrams and statistical tables give at a glance the amount and relative importance of the trade of various parts of the Empire. There are many inset maps and diagrams, amongst them being a series of historical maps giving the dates of the acquisition of the various units of the Empire, sketches of British ships of different dates from the eleventh century to the present time, drawn on the same scale and intended to give a general idea of the evolution of the Navy. Round the border are the flags of the Empire. The price of the map is 35*s*.

Memorial to Colonel A. R. Clarke.

Colonel Alexander Ross Clarke was for many years resident in Southampton during his long service as an officer of the Ordnance Survey. Between the

years 1854, when he returned from service in Canada, and 1881, when he suddenly resigned his position on the Survey and his interest in Geodesy, he completed the account of the Principal Triangulation of the United Kingdom, the Comparison of the Standards of Length, and his famous but now almost unobtainable Text-book of Geodesy. These works contained respectively his first, second, and third Figure of the Earth. His is the greatest name in British geodesy, and a pleasant incident in the meeting of the British Association was the unveiling by the President of a memorial tablet placed by the Corporation of Southampton on the house where he lived. The Mayor attended in civic state. Colonel Clarke's eldest son gave some interesting recollections of his father at work, undisturbed by the noise of a large family so long as they did not speak to him, and some eight or nine members of the Clarke family were guests at an informal lunch at which the Director-General of the Ordnance Survey presided.

OBITUARY

Charles Jacot-Guillarmod

A FEW months ago the Mount Everest Committee counted itself fortunate in securing the services of M. Jacot-Guillarmod to draw the map of the Mount Everest *massif* for the third book of the Expedition. He came to London in April and worked for eleven weeks at the Society's House. During those weeks we all learned to esteem his amiability as a man not less highly than his supreme ability as a mountain draughtsman. He had not only the skill to represent rock-faces by masterly drawing: but—equally important—his life-long knowledge of mountains and glaciers enabled him to interpret photographs in an extraordinary way. Basing his work upon the surveys of Major Wheeler in 1921, and studying the great mass of photographs from the three expeditions, he finished in June the beautiful map of the mountain which is published with the book; and he had hoped to return this autumn to extend the map eastwards to Mahabu and westwards to the Kyebrak. But a few weeks after he had left us he died suddenly in Switzerland, to the great loss of cartography, and the profound regret of the friends he made everywhere.

A. R. H.

CORRESPONDENCE

The Depth of Nile Mud in the Upper Sudan

IN the April *Journal*, on p. 337, Mr. Parkinson discusses the depth of the Nile mud in the Upper Sudan, and quotes Major Stevenson Hamilton's statement that in the Pibor District "permanent water can seldom be found at depths of less than 140 feet through solid clay."

The following figures for wells of permanent water dug at military stations in the Pibor River District, through the black cotton soil of an almost perfectly level country, may be of interest:

Pibor Post, lat. 6° 48′ N., long. 33° 10′ E., depth to water 87 feet (approx.).
Bonjak, lat. 7° 26′ N., long. 33° 22′ E., depth to water 65 feet (approx.).
Akobo, lat. 7° 48′ N., long. 33° 5′ E., depth to water 45 feet.

The well at Akobo is some 8 feet above black cotton soil, on the top of a

mound formed of the *débris* of many years of native occupation. Below the 8 feet of *débris* comes about 10–15 feet of black cotton soil, and then follows whitish clay mixed with hard lime-like nodules. This clay gradually becomes more sandy until permanent water is struck in sand.

In 1918, when water was struck in this well, small frogs were drawn up in the water.

Although all three wells are within 200 yards of a river there is no percolation of water from the cotton soil of the river-beds.

C. R. K. BACON, Lieut.-Col.

Akobo, S. Sudan,
6 June 1925.

Concerning the Wi Ch'u

In Mr. Kingdon Ward's map of Yün Nan (*Geogr. Journ.*, Sept. 1924), a river romanized as the "Yü" is made to enter the Salween above Men Kong. In other maps the same river has been shown as the Oi and Oui. These latter names seem to agree with a Chinese authority, 'The Hsi Tsang T'u Ka'o' (Illustrated Treatise on Tibet). In vol. 5 of that work and p. 4 mention is made of the Oh-i T'su Ho, and the length and embouchure both lead us to assume it is the "Yü" of Ward's map.

I have been on the lower reaches of this river, and offer the following notes: At dPal rTug (*pron.* Pei Tu), where it may be about 70 feet wide, the river is commonly known as the Wa'i-C'hu or Dra'i ch'u; names which refer to a settlement one day below and to a region and lamasery two days above dPal rTug, respectively. The name of the lamasery is popularly Dra Yul Gou pa; and Dra'i Ch'u simply means "The river of Dra Yul"; Wa'i-Ch'u, "The river of Wa-(po)." The combination "Wa'i," which has been romanized Wi, is pronounced much like the English "wee," and the Chinese "Oh-i" is not a bad adaptation.

I have heard the river called the Chia- and Tsa-ch'u, but "Yü" is quite new to me. "Dra Yul" (Yü) may easily be "Bya Yul," or the "region of Birds"; and the "Chia-Ch'u" would present no difficulty. But "Yul," which means "country or region," would be an unusual name for any feature. Of course if the "Yü" is "Dbus" (Yü), the word for "middle" or "centre," the designation is quite suitable. But I am unacquainted with it.

In any case, it seems that, with the Chinese opinion expressed in an official work, and an approximate rendering in earlier European maps before us, "Yü" should not be allowed to be an adequate rendering of the Tibetan Wa'i, which as regards sound, is almost identical with the Scotch "wee."

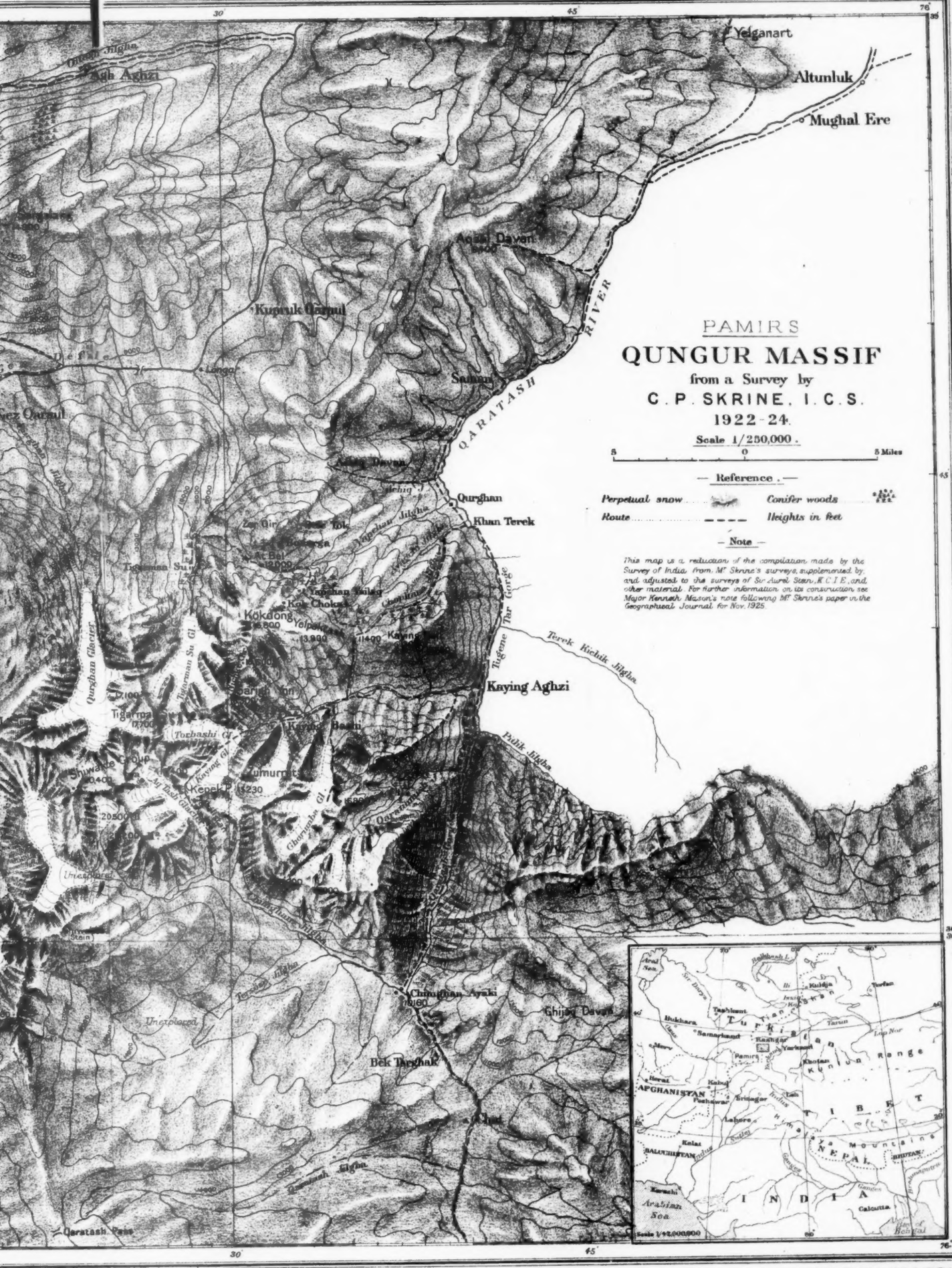
It would be misleading to try and fix a meaning for the unusual syllable Wa. It may mean "Fox," or "Spout," or "Channel," or even one of the "Lunar Mansions." But the second and third of these meanings are suggestive in view of the remarkable bends in the river just before entering the Salween.

The Chinese authority (T'ukao) mentioned above, gives the following note: "The Oh-i Tsu (*sic*) River is west of the city of Tsa Tso Li Kang. The source is 300 li to the north of the town. From the Nah Lan Ranges it flows south to Chia La Mu Chī, where it enters the Salween (Lu Kiang)."

J. HUSTON EDGAR.

c/o China Inland Mission, Tatsienlu, W. China.

75.
15
35
45
35 30
Bill Ush
Oi Bagh Gl.
Tarmag Bash
Langar
Bulan Kol
Qungur
Qungur II
Qungur Glacier
Kok Sel Glacier
Qizil Sel Glacier
Basik Kol
Little Oprang Kol
Shimshal



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QUNGUR MASSIF
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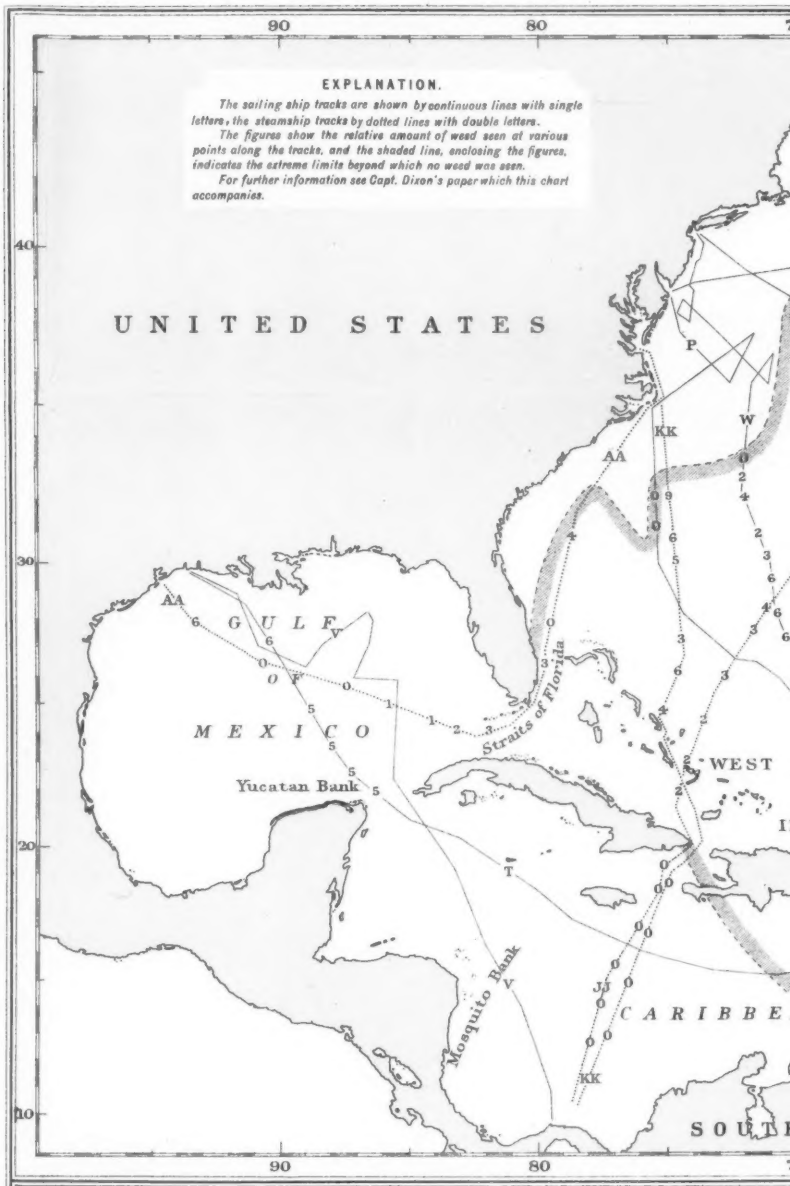
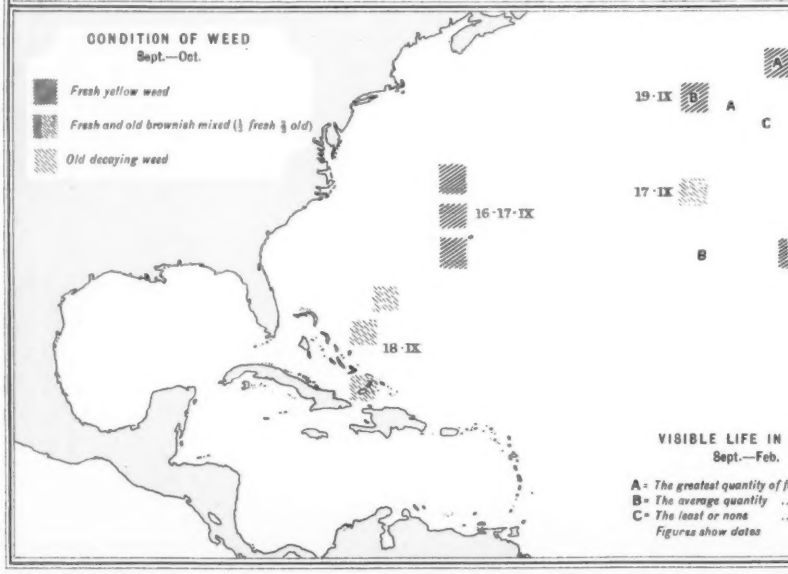
LIST OF PASSAGES

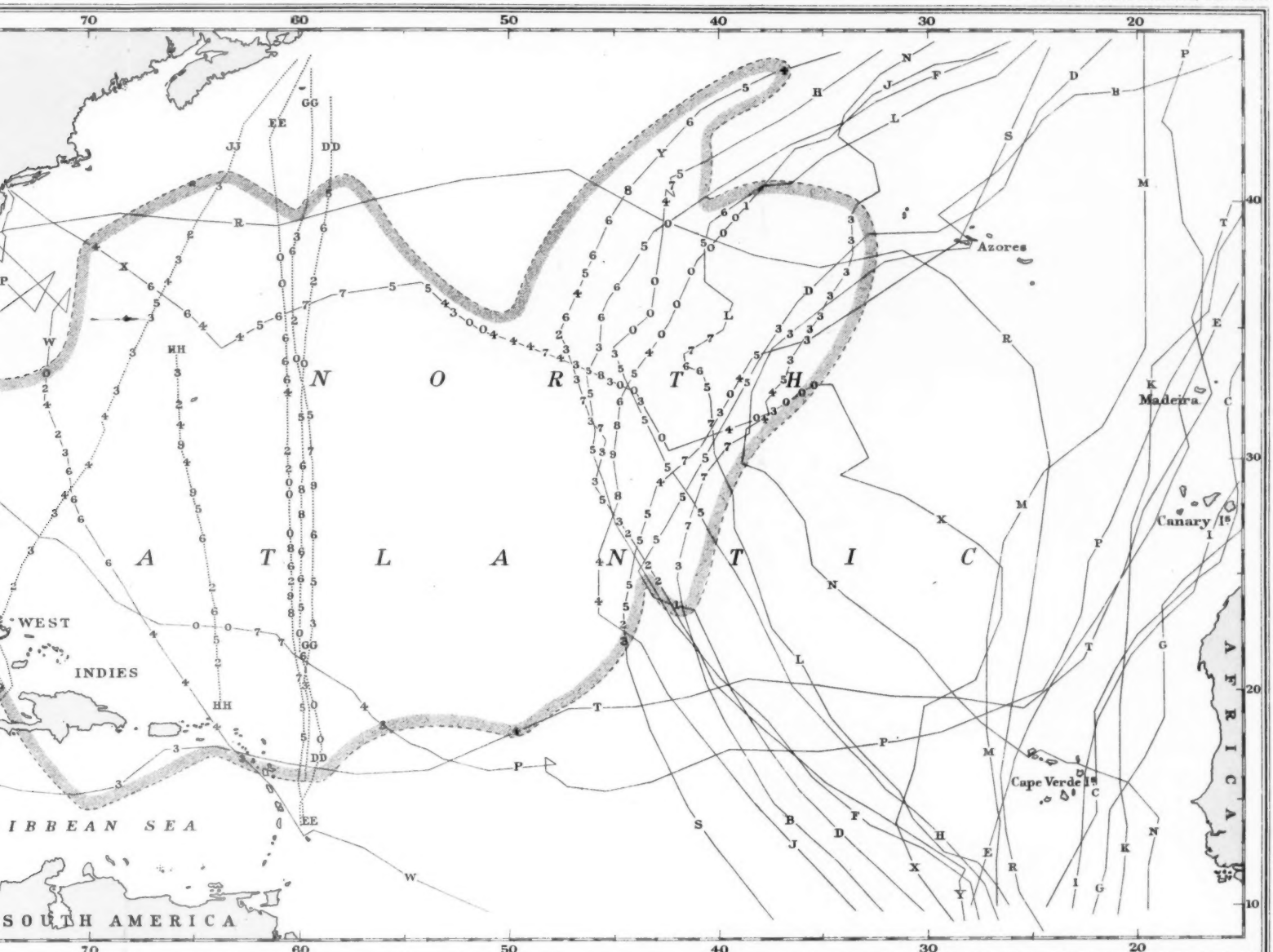
Sailing Ship Tracks

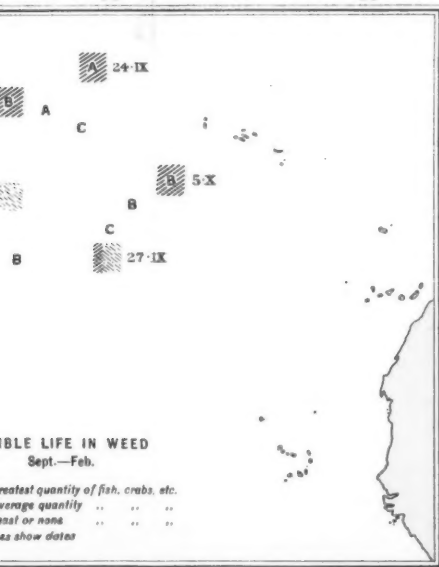
Reference letter on Chart	From	To	Dates of crossing Nth. Atlantic	
A	St. John, New Bruns.	Adelaide, Australia	Sept. 29	Oct. 28 (No data for track)
B	Sydney, N.S.W.	Rotterdam	June 29	July 24
C	Rotterdam	Portland, Oregon	Sept. 24	Oct. 6
D	Portland, Oregon, U.S.	Queenstown	June 23	July 16
E	Glasgow	Sydney, N.S.W.	Oct. 9	Oct. 25
F	Talcahuano, Chile	Queenstown	July 13	August 3
G	The Tyne	Portland, Oregon	Nov. 6	Nov. 16
H	Portland, Oregon, U.S.	Queenstown	August 13	Sept. 1
I	Port Talbot, Wales	Caleta Coloso, Chile	Dec. 1	Dec. 9
J	Port Pirie, S. Australia	Queenstown	June 19	July 11
K	Barry, Wales	Rio de Janeiro	Sept. 25	Oct. 9
L	Port Pirie	Queenstown	July 4	August 4
M	Sunderland	Santos, Brazil	Nov. 12	Nov. 22
N	Depuch Is., N.W. Australia	Liverpool	Sept. 5	Oct. 11
P	Liverpool	Philadelphia	Feb. 19	April 7
R	Philadelphia	Fusan, Korea	April 29	May 28
S	Portland, Oregon	Hull	May 18	June 3
T	Hull	Port Arthur, Texas	Sept. 8	Oct. 13
V	Port Arthur, Texas	Australia via Panama	Nov. 16	Nov. 30
W	Pagumene, New Caledonia	New York	June 2	July 2
X	New York	Sydney, N.S.W.	Oct. 4	Nov. 4
Y	Sydney, N.S.W.	Liverpool	Sept. 4	Sept. 27
		Steamship Tracks		
AA	Galveston, Texas	Norfolk, Virginia	April	——
DD	River St. Lawrence	Demerara, Br. Guiana	May 15	May 31
EE	Trinadad, West Indies	River St. Lawrence	June 7	June 21
GG	River St. Lawrence	Trinadad, W.I.	June 6	June 20
HH	St. Kitts, West Indies	River St. Lawrence	June 27	July 2
JJ	River St. Lawrence	Australia via Panama	Sept. 15	Sept. 25
KK	Vancouver via Panama	New York	July 11	July 20

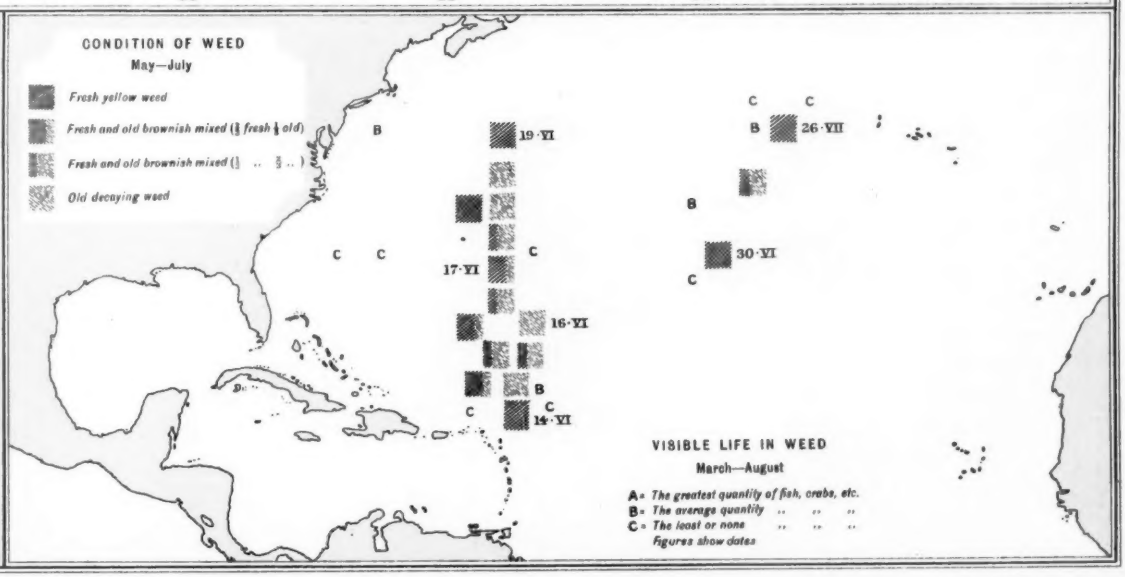




to illustrate the paper on **"THE SARGASSO SEA"** by Capt. Charles C. Dixon.







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SARGASSO SEA
Dixon